Project Management for Instructional Designers

Project Management for Instructional Designers

First Canadian Edition

ETAD 874

Cover photo credit by HAKINMHAN
"Sharing ideas concepts with papernote writing strategy on wall glass office"

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About This Book

Project Management for Instructional Designers (PM4ID), the First Canadian Edition, is a textbook designed for graduate students to enhance their knowledge of project management and instructional design. PM4ID is a derivative of a pre-existing, openly licensed project management book donated to the commons by a benefactor who prefers anonymous attribution.

This textbook offers new features and improvements, including:

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New cover design, updated fonts, and enhanced list of Glossary terms.
- Addition of four new case studies, written to deepen reader comprehension.
- Inclusion of images with diverse skin tones, body shapes, abilities, and gender to increase representation.
- Revised content to feature Canadian spelling and contexts.
- Overall review of all written material in the textbook with detailed notes documenting content revisions.
- Comprehensive revisions based on peer reviews collected by the Open Textbook Library.
- Significant revisions to Chapter 6, with major updates to content on communication and scheduling (project management) software focusing on web-based solutions.
- Multiple versions of the book, including PDF, EPUB, HTML, MOBI, and all chapters are available in natural voice audio recordings.
- A series of video cases with interviews of Canadian instructional design experts (video and audio recordings).
- Interactive reviews of three chapters using H5P activities.

The First Canadian Edition of PM4ID was revised and updated by an elite team of graduate students in Paula MacDowell's ETAD 874: *Advanced Instructional Design* course. The goal was to create an affordable and accessible text intended to improve how students learn about instructional design in graduate programs at the University of Saskatchewan and beyond.

The student and faculty contributors include Alicia Accettura, Kurt Bergsma, Tyler Boszak, Jennifer-Lynn Callaway, Nicholas Cote, Chris Doepker, Matthew Harbidge, Shua Her, Trevor Hlushko, Jordy Holmes, Michael Knight, Paula MacDowell, Carole Marshall, Lee McDougall, Anthony Prima, and Thomas Story.

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Other Editions

We acknowledge the first edition of PM4ID was created by students in David Wiley's IPT 682: *Introduction to Project*

Management class at Brigham Young University during Fall term 2011. The team included: Maya Amado, Kevin Ashton, Scott Ashton, Jay Bostwick, Vera Nan, Tony Nisse, and Dan Randall.

We acknowledge the second edition of PM4ID was created by students in David Wiley's IPT 682: *Introduction to Project Management* class at Brigham Young University during Fall term 2012. The team included: Geri Clements, Jeffery Drysdale, Jenifer Francis, Buck Harrison, Joseph Rino, Jared Robinson, and Aaron Snyder.

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CHAPTER 1

1 Introduction to Project Management

1.0 Overview

Visit Audio Recordings for the audio version of this section.

Welcome to Project Management for Instructional Designers!

The book you are now reading is an ongoing work in progress. As many of those reading this book may be pursuing a career or further expertise in **project management**, it is important to outline how this book fits with other texts or certification requirements of the field. This book is designed to provide an overview of project management principles in instructional design, not as preparation for certification exams. However, in an effort to bridge the practical application principles with the knowledge needed for certification, each chapter of this text will begin with a reference to the foundational text from the Project Management Institute (PMI) entitled A Guide to the Project Management Body of Knowledge (PMBOK),[1] as well as two of the main certification exams – the Project Manager Professional Certification (PMP) and the Certified Associate in Project Management (CAPM). These references are meant to aid any reader who may be using this text to supplement their pursuit of other professional goals. The PMI, PMBOK, PMP, and CAPM are explained below.

Project Management Institute (PMI)

"PMI is one of the world's largest not-for-profit membership associations for the **project management** profession, with more than 650,000 members and credential holders in more than 185 countries." They advocate **project management** as a profession and have created "globally-recognized standards and credentials, [an] extensive research program, and . . . professional development opportunities. These products and services are the basis of greater recognition and acceptance of project management's successful role in governments, organizations, academia and industries." [2]

A Guide to the Project Management Body of Knowledge (PMBOK)

The PMBOK is the recognized standard from PMI that shares established norms, methods, and processes that constitute good practices of project managers. It is a document that has evolved through contributions of high-quality practitioners. This text defines **project management** as well as other important concepts, and describes the relevant processes for managing a project. It is this text that defines the content for which project managers will be held accountable in certification exams.

Project Manager Professional Certification (PMP)

The Project Manager Professional (PMP) certification is one of the most well-recognized certifications for **project management**. Companies increasingly require project manager applicants to have a PMP certification, thus making this certification important in applying for jobs and setting yourself apart. Those who certify as a PMP show they are educated, competent and experienced project managers. Certifying as a PMP can be done in two different ways.

Method 1

1. A bachelor's degree
2. 3 years of **project management** experience
3. 4500 hours of leading projects
4. 35 hours of **project management** education
5. Pass the Test

Method 2

1. High school degree
2. 5 years of **project management** experience
3. 7500 hours of leading projects
4. 35 hours of **project management** education
5. Pass the Test

The PMP test has 200 multiple-choice questions, 25 of the questions are experimental questions for future exams and will not count toward your final score. A passing rate is usually around 106/175 (about 61%). The PMP test is very specific and will require more effort than just reading the PMBOK book to pass the exam.[3] Questions on the exam assume that the project is being managed using the principles in the PMBOK. The test further assumes that projects would operate perfectly within the **parameters** the book describes. Many questions will have good answers but you must be able to select the best answer. The test is focused around the Project Management Process, as described in the PMBOK. The following table breaks up the Project Management Process and shows the number of questions that are generally affiliated with that topic on the exam.

Test Topic	Percentage of Questions
Initiating a Project	13%
Planning a Project	24%
Executing a Project	30%
Monitoring and Controlling a Project	25%
Closing a Project	8%

Certified Associate in Project Management (CAPM)

The PMI provides an introductory certification for project managers called the Certified Associate in Project Management or CAPM. The requirements for the CAPM are much less stringent than those for the PMP. The prerequisites can be met in two different ways: (1) obtain 1,500 hours of **project management** experience, or (2) complete 23 hours of **project management** instruction. Many post-secondary **project management** courses include more than 23 instructional hours.[4] In fact, if you are reading this book for a **project management** course, you will probably meet the prerequisites for the exam through your class experience. The questions for the CAPM are organized differently than those for the PMP. The exam blueprint provided by PMI is based on percentages of test questions coming from each chapter of the PMBOK.

Test Topic and PMBOK Chapter	Percentage of Questions
Ch. 1: Introduction	4%
Ch. 2: Project Life Cycle and Organization	4%
Ch. 3: Project Management Processes	11%
Ch. 4: Integration Management	11%
Ch. 5: Scope Management	11%
Ch. 6: Time Management	11%
Ch. 7: Cost Management	9%
Ch. 8: Quality Management	7%
Ch. 9: Human Resource Management	7%
Ch. 10: Communications Management	7%
Ch. 11: Risk Management	11%
Ch. 12: Procurement Management	7%

Because the examination blueprint comes directly from the PMBOK, effective exam preparation will include a detailed study of the PMBOK and possibly another exam-preparation book.[5]

The format of this book is as follows:

- The content is organized in a roughly chronological pattern, corresponding to the order in which you will likely be called on to use the principles in this book. However, all of the information can be applied in any stage of a project.
- Each chapter has an Overview section which introduces the chapter topic and references the PMP and CAPM exam areas that correlate.
    - This chapter aligns with Chapter 1 of the PMBOK and 4% of the CAPM questions come from this knowledge area. The content connects to the Initiating and Planning category of the PMP questions.
- The Overview sections also contain videos of three instructional design project managers who relate how the chapter's principles applied to their individual projects.
- The chapter sections will each contain:
    - Learning objectives will help guide your reading in identifying key points.
    - Glossary words to increase understanding of key terms will be in bold and give their definition within the text.
    - Interviews with instructional design experts and case studies will enhance your understanding of the chapters.
    - Key takeaways and interactive reviews will summarize the learning objective information.

We hope you find the book useful and informative.

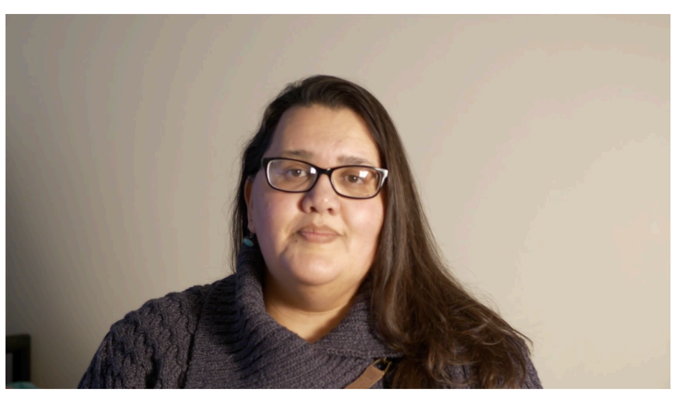
Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=22

Well, I'm Rick Schwier and I'm a professor of educational technology and design. I've been an instructional designer for too long, for a very long time. Since 1978, I've been at the University of Saskatchewan and in that time I've worked with students in instructional design. Click here to access transcript.

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan



My name is Kristine Dreaver-Charles and I am an instructional designer at the Distance Education Unit at the University of Saskatchewan. I am a member of the Mistawasis First Nation and an educator. Click here to access transcript.

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

My name is Andy Gibbons. I'm an instructional designer. I have been since about 1974. I worked eighteen years in industry, and the project that I'd like to talk about was for the U.S Navy, teaching helicopter pilots how to fly a particular anti-submarine warfare helicopter. And teaching operators called center operators who sit in the back of the aircraft looking for squiggles on a piece of paper that would indicate that they have found a submarine. The project was actually just about a year long, and it was full of interesting experiences.

Heather Bryce – Independent Studies – BYU

My name is Heather Bryce, and I am the project manager for Brigham Young University Independent Study and I have been working here for three years. The project I will be discussing today is Art 45.

Dr. Larry Seawright – Center for Teaching and Learning – BYU

I'm Doctor Larry Seawright. I'm Associate Director at the BYU Center for Teaching and Learning. I'm also project manager for a project we call the BYU Learning Suite, which is what I'm going to be talking about today.

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[1] Project Management Institute (2008). A guide to the project management body of knowledge (PMBOK guide, fourth edition). United States of America: Project Management Institute.

[2] http://www.pmi.org/About-Us.aspx

[3] Mulchay, R. (2011). PMP Exam Prep. United States of America: RMC Publications.

[4] Project Management Institute (2012). CAPM certification handbook. Available from http://www.pmi.org/certification/~/media/pdf/certifications/pdc_capmhandbook.ashx

[5] Mulcahy, R. (2009). CAPM Exam Prep. United States of America: RMC Publications.

1.1 Project Management Defined

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify the Project Management Institute's definition of **project management**.
2. Analyze and evaluate the role of client expectations in a project.
3. Define **project scope**.

One of the priorities of the Project Management Institute (PMI) during the 1980s was to define **project management** and develop it as a profession. Debate continues on whether **project management** is a profession with an enforceable code of conduct and other traditional criteria for recognition as a profession. However, PMI's development of A Guide to the Project Management Body of Knowledge (PMBOK), and the **project management** certifications that derived from these efforts, helped promote the understanding and development of the **project management** field. Defining **project management**, and substantiating it as a profession, brought about the question of its purpose. Intense discussions resulted in a compromise to define ***project management*** as "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements."[1]

Be aware that PMI's definition is not the only view of what **project management** entails. Jack Meredith and Samuel Mantel[2] discussed **project management** in terms of producing project outcomes within the three objectives of cost, schedule, and specifications. According to this view, **project management** is the application of everything a project manager does to meet these **parameters**. This approach to defining **project management** shares PMI's focus on the project outcomes in terms of requirements, but Meredith and Mantel also added a fourth aspect of **project management**—the expectations of the client.


Image by petecocoon

If it is assumed that the client is the one who defines project requirements, then maybe **project management** is the application of knowledge, skills, tools, and techniques to meet client requirements. This definition focuses on expectations rather than project specifications. It is possible to meet all project specifications and not meet client expectations. It is also possible to only accomplish one or more of the specifications, yet still meet or exceed a client's expectations.[3]

PMI's definition of **project management** provides a good understanding of **project management**, but it does not help us understand project success. For that, we must include the client.

District Curriculum Alignment Project

A school district in Colorado, USA, invested a substantial portion of the budget toward switching to a professional learning community (PLC) model for faculty development. The district requested a project that would align the curriculum with each subject and grade level and be used as benchmarks evaluating the PLC's work with students. The project brought together teachers from across the district to design essential learning objectives, which would be taken back to schools and PLCs. The project team created the essential learning objectives within the budget and time constraints that were approved by the district, but teachers at the individual schools were unhappy that the learning objectives were decided at the district level rather than at the school level. Even though this project met all the original goals, the district was still disappointed.

Meredith and Mantel discussed a tendency noted by Russ Darnall[4] that expectations often increase during the life of a project. Meredith and Mantel suggest that this is a form of scope increase. ***Project scope*** is reflected in a carefully crafted document that reflects the performance specifications of the project deliverables. Defining the **project scope** and managing scope change is a very different process from developing an understanding of a client's expectations and managing those expectations. Darnall focused on defining and managing client expectations as a critical **project management** skill that is distinct from scope development and management.

Client expectations encompass an emotional component that includes many client desires that are not easily captured within a specification document. Although closely correlated with project specifications, client expectations are driven by different needs. It is possible for a project team to exceed every project specification and end up with an unsatisfied client.

The reverse is also true. A project can be late and over budget and the client can be satisfied. Although this may be counterintuitive, the response of a client to the events of a project is complex and goes beyond the data related in project specifications.

Volunteer Training Program

A museum planned to use volunteers as gallery interpreters to facilitate a more engaging guest experience. The museum hired instructional designers to manage a project to plan, develop, and implement training for prospective volunteers. The original project specifications called for the training to last four hours. Throughout the project, it became clear to the project manager that the complexity of the learning objectives required more than four hours of training. The change in scope was approved by the museum, resulting in a significant increase in the total cost of the project. The museum, however, was satisfied with the project because it produced an effective training for volunteers. Client satisfaction is often tied to expectations about project performance. Identifying and managing those expectations is a primary responsibility of the project manager.

KEY TAKEAWAYS

- According to PMI, project management is the application of knowledge, skills, tools, and techniques to meet project requirements.
- The role of the client is crucial. Some experts include meeting or exceeding client expectations as a definitive element of **project management**.
- **Project scope** is a document that defines the work required to complete the project successfully.

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[1] Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008), 6.

[2] Jack R. Meredith and Samuel J. Mantel, Jr., Project Management: A Managerial Approach(Hoboken, NJ: Wiley, 2006), 8.

[3] Russell W. Darnall, The World's Greatest Project (Newtown Square, PA: Project Management Institute, Inc., 1996), 48–54.

[4] Russell W. Darnall, The World's Greatest Project (Newtown Square, PA: Project Management Institute, Inc., 1996), 48–54.

1.2 Project Definition and Context

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe two defining characteristics of a project.
2. Understand project levels and organization priorities.
3. Describe the organizational options for managing projects.

Before elaborating further on **project management**, let's first identify what a project is and how projects come about. PMI defines a **project** by its two key characteristics: it is temporary and undertaken to create a product, service, or result that is unique.[1] Projects are undertaken by various organizations to better fulfill their purposes.

Organizational Priorities

Organizations fulfill societal functions (e.g. economic, religious, community support, government, etc.) Local factories, churches, and hospitals are all organizations that provide some social or community need. Factories create wealth and jobs, churches provide spiritual and common social needs for communities, and government organizations provide regulations and services that allow for an orderly society. These organizations have different views of time and each organization develops an operational approach to accomplishing the purpose of the organization over that time horizon. For example, a religious group might begin construction of a cathedral that would take several lifetimes to complete, government performance is reviewed at election time, and a publicly owned company must justify its use of money each year in the annual report.

Organizations operate to effectively and efficiently produce the product or service that achieves the organization's purpose and goals as defined by the key ***stakeholders***—those who have a share or interest in the organization. An organization seeks to develop stable and predictable work processes and then improve those work processes over time through increased quality, reduced costs, and shorter delivery times. **Total quality management**, lean manufacturing, and several other management philosophies and methodologies have focused on providing the tools and processes for increasing the effectiveness and efficiency of the organization. Historically, these methodologies focused on creating incremental and continuous improvement in work processes. More recently, organizations are increasingly focused on *step changes* that take advantage of new technologies to create a significant improvement in the effectiveness or efficiency of the organization.

Often, these initiatives to increase organizational effectiveness or efficiency are identified as projects. Economic organizations might initiate a project to produce a new product, to introduce or revamp work processes to significantly reduce product costs, or to merge with other organizations to reduce competition or lower costs and generate additional profits. A social organization, such as a hospital, may build a new wing, introduce a new service, or design new work processes to reduce costs. A government organization may introduce a new software program that handles public records more efficiently, build a new road to reduce congestion, or combine departments to reduce costs.

Each of the initiatives meets our definition of a project. Each is a temporary endeavor and produces a unique product or service. Projects are also defined within the context of larger projects as the following example illustrates.

National Energy Saving Education Plan

The National Energy Technology Laboratory laid out a plan for a national energy-saving education plan that had a clear and identifiable outcome—helping consumers efficiently find and use reliable, affordable, and environmentally sound energy.[2] The details of this plan will be revised and updated, but the general goals are likely to remain unchanged. To accomplish these goals, the project requires the development of educational materials related to new technologies, coordination with many instructional designers, and skillful stakeholder management. Development of each of the major components became a project for the instructional design teams within the larger project of providing educational materials to consumers related to finding and using reliable, affordable, and environmentally sound energy. Each project has to develop materials related to new technologies and manage the **stakeholders** at the Department of Energy. Each instructional design team becomes a project for that organization. The project is defined by the scope of work. In the energy materials area, the scope of work included all activities associated with educating consumers on ways to reduce the use of fossil fuels and reliance on imported energy. Using our definition that a project is a temporary endeavour that creates a unique product or service, implementation of the energy education materials would be a project that consisted of other projects. These projects could develop into creating education materials related to wind power, solar power, electricity transmission, biofuels, environmental protection, etc.

Organizing to Manage Projects

Because **project management** is different from operations (organizational) management, projects are handled best by people who are trained in **project management**. This expertise can be obtained by hiring an outside consulting firm that specializes in **project management** or by developing an in-house group.

Some organizations are designed to execute specific projects. Often entities contract with engineering and construction companies to design and build their facilities or hire software companies to develop a software solution. The major work processes within these organizations are designed to support the acquisition and execution of those projects. Similarly, there are instructional design firms who have the specialized skills to design valuable instruction effectively and efficiently for their clients. The ability of these types of organizations to successfully manage projects in house becomes a competitive advantage for them in the marketplace.

Organizations designed to produce products or services also use projects. Major activities outside the normal work of the organization's department or functional units or major activities that cross functional boundaries become a project. As economic pressures increase the speed in which organizations must change and adapt to new environmental conditions, leaders are increasingly chartering projects to enable the organization to adapt more quickly. The application of a **project management** approach increases the likelihood of success as organizations charter a project to facilitate organizational change, to increase the development and introduction of new products or support the merger or divesture of organizational units.

Image by fauxels

Project management offices (PMOs) have emerged within organizations to facilitate development of organizational knowledge, skills, and tools to internally charter and manage projects. The PMO varies in structure and responsibility depending on the **project management** approach of the parent organization. On one end of the spectrum, the PMO has complete responsibility for projects within an organization from the criteria and selection of appropriate projects to accountability for project performance. In organizations that make a large investment in the PMO, a large number of new product or process improvement projects are submitted, and the project office develops a portfolio of projects to manage over a given period that maximizes the use of organizational **resources** and provides the greatest return to the organization.

PMOs can provide various functions for an organization. Some possible functions include the following:

- **Project management**. Some organizations maintain the project manager within the PMO, assign project managers from other departments, procure contract project managers, or practice a combination of all three.
- Center of excellence. The project office can maintain the organization's **project management** policies and procedures, maintain a historical database, maintain best practices, and provide training and specialized expertise when needed.
- Portfolio management. The project office supervises the project managers and monitors project performance. Portfolio management also includes prioritizing projects based on the value to the organization and maintains an inventory of projects. Portfolio management balances the number and type

of projects to create the greatest return from the entire portfolio of projects.
- Functional support. The project office maintains **project management** expertise to support the project. Estimating, project scheduling, and project cost analysis are examples of functional support.

KEY TAKEAWAYS

- All projects are temporary and undertaken to create a product, service, or result that is unique.
- In an organization, **project management** can be used to make step changes to take advantage of new technologies or make significant improvements in effectiveness or efficiency.
- Projects can be handled by outside contractors or by an internal group in a PMO.

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[1] Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008), 5.

[2] National Energy Technology Laboratory, "Reliable, Affordable, and Environmentally Sound Energy for America's Future," The Energy Lab, 2001,http://www.netl.doe.gov/publications/press/2001/nep/nep.html(accessed June 18, 2009).

1.3 Key Skills of the Project Manager

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Compare **project management** and operations management.
2. Identify necessary leadership skills required of a project manager.

Often the difference between the project that succeeds and the project that fails is the leadership of the project manager. Each project team is a group of individuals who needs motivation and coordination. Planning is vital, but the ability to adapt to changes and work with people to overcome challenges is just as necessary. A project manager must master the skills that are necessary to be successful in this environment. The unique and temporary nature of projects creates a work environment that mandates a different management approach from that used by an **operations manager**.

Operations Managers

One way to improve understanding of **project management** is to contrast **project management** with operations management. All ***operations managers*** are charged with efficiently and effectively achieving the purpose of the organization. Typically, managers of economic organizations focus on maximizing profits and stockholder value; leaders of socio-religious organizations focus on effective and efficient delivery of a service to a community or constituency; and governmental managers are focused on meeting goals established by government leaders. For our purposes, each of these managers would be deemed the "operations manager".

More effective work processes will produce a better product or service, and a more efficient work process will reduce costs. **Operations managers** analyze work processes and explore opportunities to make improvements. **Operations managers** are process focused, oriented toward capturing and standardizing improvement to work processes and creating an organizational **culture** focused on the long-term goals of the organization. Often, specific projects are undertaken to improve their overall operational processes.

Operations managers create a **culture** which focuses on the long-term health of the organization and build teams over time to standardize and improve work processes. They search for and nurture team members who will "fit in" and that contribute to both the effectiveness of the team and the team **culture**. **Operations managers** are long-term focused and oriented toward continuous improvement of existing processes over longer periods of time.

An **operations manager** may invest $10,000 to improve a work process that saves $3,000 a year. Over a five-year period, the **operations manager** improved the profitability of the operations by $5,000 and will continue to save $3,000 every year. The project manager of a one-year project could not generate the savings to justify this kind of process improvement and would not invest **resources** to explore this type of savings. However, the project manager might head the $10,000 project that the **operations manager** solicited to improve the work process of the organization.

Project Managers

Project managers focus on the goals of the project. Project success is connected to achieving the project goals within the project timeline. Project managers apply **project management** tools and techniques to clearly define the project goals, develop an execution plan to meet those goals, and meet the **milestones** and end date of the project. A project manager needs a different set of skills to both define and successfully execute projects. Because projects are temporary, they have a defined beginning and end. Project managers must manage start-up activities and project closeout activities. The processes for developing teams, organizing work, and establishing priorities require a different set of knowledge and skills because members of the **project management** team recognize that it is temporary.

Project managers create a team that is **goal** focused and energized around the success of the project. Project team members know that the project assignment is temporary because the project, by definition, is temporary. Project team members are often members of organizational teams that have a larger potential to affect long-term advancement potential.

They seldom report directly to the project manager and the effect of success or failure of the project might not affect their reputations or careers the same way that the success or failure of one of their other job responsibilities would. Therefore, project managers create clear goals and clear expectations for team members and tie project success to the overall success of the organization. Project managers are **goal** directed and milestone oriented.

While there are many skills needed by a project manager that are the same as an **operations manager**, because project managers generally operate in an environment that is more time sensitive and **goal** driven, the successful project manager requires additional knowledge, skills, and abilities.

Image by Anna Shvets

Albert Einsiedel[1] discussed leader-sensitive projects and defined five characteristics of an effective project leader. These characteristics were chosen based on some assumptions about projects. These characteristics include the **project environment**, which is often a matrix organization that results in role ambiguity, role conflict, and role erosion. The **project environment** is often a fluid environment where decisions are made with little information. In this environment, the five characteristics of an effective project leader include the following:

- Credibility – the project manager is coming into an established organization and must have a reputation or presence of credibility to receive the respect and support of the client and team.
- Creativity as a problem solver – projects are never "business as usual".
- Tolerance for ambiguity – a project manager can often be unfamiliar with the kind of work the client does and needs to be able to adapt and move the project forward, even if all aspects of the company aren't understood perfectly.
- Flexible management style – a project manager is constantly dealing with new people and environments and must adjust accordingly. They do not have the luxury of an established rapport with their project associates.
- Effective communicating – because of the ambiguous nature of projects, good communication skills are crucial in understanding what is expected by the client and being able to convey that vision to the project team.

Hans Thamhain[2] researched the training of project managers and, based on the finding, created a taxonomy wherein the qualities of a project manager are categorized into the following three areas:

- Interpersonal skills. These skills include providing direction, communicating, assisting with problem solving, and dealing effectively with people without having authority.
- Technical expertise. Technical knowledge gives the project manager the creditability to provide leadership on a technically based project, the ability to understand important aspects of the project, and the ability to communicate in the language of the technicians.
- Administrative skills. These skills include planning, organizing, and/ managing/ overseeing/ coordinating the work.

Traditionally, the project manager has been trained in skills such as developing and managing the **project scope**, estimating, scheduling, decision making, and team building. Although the level of skills needed by the project manager depends largely on the complexity of the project, the people skills of the project manager are increasingly more important. The skills to build a high-performing team, manage client expectations, and develop a clear vision of project success are the type of skills needed by project managers on more complex projects. "To say Joe is a good project manager except he lacks good people skills is like saying he's a good electrical engineer but doesn't really understand electricity."[3]

KEY TAKEAWAYS

- Operations managers are long-term focused and process oriented. Project managers are **goal** directed and milestone oriented.
- Project managers need the same skills as an **operations manager**, such as good communication, team building, planning, expediting, and political sensitivity.

- Project managers need additional skills in establishing credibility, creative problem solving, tolerance for ambiguity, flexible management, and very good people skills.

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[1] Albert A. Einsiedel, "Profile of Effective Project Managers," Project Management Journal 18 (1987): 5.

[2] Hans J. Thamhain, "Developing Project Management Skills," Project Management Journal 22 (1991): 3.

[3] Russell W. Darnall, "The Emerging Role of the Project Manager," PMI Journal (1997): 64.

1.4 Introduction to the Project Management Knowledge Areas

LEARNING OBJECTIVES

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

Projects are divided into components, and a project manager must be knowledgeable in each area. This section provides an overview of these knowledge areas, each of which will be explored in more depth in subsequent chapters.

PROJECT START-UP AND INTEGRATION

The start-up of a project is similar to the start-up of a new organization. The project leader develops the project infrastructure used to design and execute the project. The project management team must develop alignment among the major **stakeholders** on the project during the early phases or definition phases of the project. The project manager will conduct one or more kickoff meetings or alignment sessions to bring the various parties of the project together and begin the project team-building required to operate efficiently during the project.

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

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

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

Project Scope

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

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

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

Description of the scope

- Product acceptance criteria
- Project deliverables
- Project exclusions
- Project constraints
- Project assumptions

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

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

Project Schedule and Time Management

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

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

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

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

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

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

Project Costs

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

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

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

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

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

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

Procurement

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

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

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

Project Quality

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

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

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

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

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

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

Project Team

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

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

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

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

Communications

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

Image by Marcus Aurelius

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

Project Risk

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

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

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

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

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

KEY TAKEAWAYS

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

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

1.5 Interactive Review

Chapter 1 Interactive Review

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://openpress.usask.ca/pm4id/?p=1821#h5p-1

CHAPTER 2

2 Project Profiling

Visit Audio Recordings for the audio version of this section.

This chapter aligns with beginning sections of most of the chapters in the PMBOK, where **attributes** are identified in specific ways. It is therefore difficult to quantify a proportion of the CAPM questions that come from this knowledge area. The content connects to the Initiation and Planning category of the PMP questions.

A project profile attempts to provide a snapshot look at the **project scope** and requirements before work actually begins. A well-crafted project profile can help when designing the **project execution plan** at a later stage, as well as in determining the assignment of resources to the project.

A project profile usually contains some or all of the following:

- Projections on project size and cost
- Analysis of project complexity
- Analysis of required technology and resources

By the end of this chapter you should be equipped with the skills necessary to successfully gauge the difficulty of a potential project as well as to forecast the required resources and time necessary through project completion.

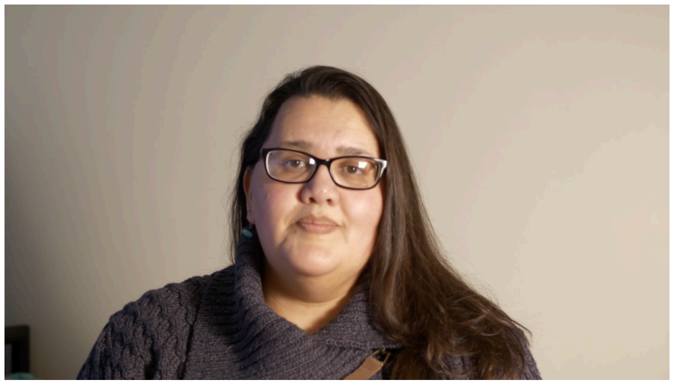
Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=36

In any project there are going to be external and internal constraints and opportunities that come up, and reading those is really important. But just acknowledging them on the front end is important with everybody who's a player. Click here to access transcript.

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan



So generally, you need to be able to do what you can with what you have. And you may have a really great idea and want to do something amazing. But it doesn't always work out. Click here to access transcript.

This project was to train helicopter pilots and sensor operators. The contract came to us as a signed contract with the Navy. It came with a certain number of resources promised to us. We had a lot of subject matter expert support on the project. On other projects that wasn't the case, but on this one we really had plenty. The thing that was interesting is as we looked at the constraints on the project there was a constraint we didn't notice that later turned out to be a big factor. Turns out that there…in the…we didn't have a lot of access to people who were actually using it on a day-to-day basis…the training….would be using the training in daily operations. And so we….our subject matter experts were off in the west coast, and it turns out that the water is different on the west coast from on the east coast. And of course quality of the water, when you're flying a helicopter and looking for submarines is a very important factor. We developed the course as if it was for the West coast. When the training was shipped to the East Coast, it was different. They couldn't use it in the same way. Actually it took some revisions of the training to adjust for that problem. We didn't know at the beginning that that was a resource problem. And so it came up and bit us later.

At the beginning of Art 45, we met to discuss the major requirements which would be editing, how long the course is, how well written the course was–that will determine our editing time, video requirements, flash requirements and art requirements. Obviously, Art 45 is an art class, drawing actually.

Dr. Larry Seawright – Center for Teaching and Learning – BYU

The BYU Learning Suite is a learning management system that's going to replace the current system at the University. As such we have lots of stakeholders, so we had to do a lot of profiling. We had to check with all of the stakeholders, faculty members, students, the University administration, and find out what all the various constituents needs were, and factor those in as we decided the scope of the project. How much could we do? How little could we do? We took a look at the existing product and the primary utilization of it. And decided that their mostly using this much, so this is how much we are going to start with. And then we verified that with all of the different stakeholders.

2.1 Using a Project Profile

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify project **attributes** that can be used for **project profiling**.
2. Define **project profiling**.

A project manager with a long history of successful projects oftentimes fails on others. What causes this to happen? Even though all projects are unique, there are ***attributes*** (such as size, cost, subject matter, etc.) that are common among projects that allow the characterization or profiling of a project. Different skills and approaches are needed by the project manager for different projects. You can imagine that the ideal project manager for a large construction project may not be a good fit for a software development project. The technical knowledge needed to manage these projects is not the same and having the wrong technical knowledge may make the difference between a successful project and project failure.

A large project that will be executed in at least three locations will have a very different profile from a small project that will be executed in one location. These two **attributes**—size and location—provide information about the project that will enable a manager in the parent organization to assign a project manager with the appropriate knowledge and skills. We can then develop an execution approach to increase the likelihood of success.

Organizations need good tools for understanding and matching the needs of a project with the project manager who has the right skills and experience. Developing a project profile is one method for gaining an understanding of the project and providing a systematic approach to developing an execution plan to select a project manager who has the right kind of experience and skills.

Image by Sora Shimazaki

Project profiling is the process of extracting a characterization from the known **attributes** of a project. The characterization will provide a more comprehensive understanding of the project that should result in developing an appropriate execution approach and the assignment of organizational **resources**. In different terms, **project profiling** is a process that summarizes what is known about the **attributes** of a project and places the project into a category with other projects that have similar characteristics. For example, you can characterize a project as a large project or a small project; the size of the project becomes the profiling attribute. You can characterize a project as domestic or global, making the location of the project the profiling characteristic.

A company that has twenty projects may determine that four of these projects are estimated to cost more than $1 million dollars and the remaining sixteen projects are estimated to cost much less. The company then communicates that all projects over $1 million be considered a large project. The company now establishes a rule that large projects will require a project manager with at least five years of management experience, it will have a vice president as executive sponsor, and it will require formal quarterly reports. In this example, one characteristic is used to develop the organization's project management approach to their twenty projects.

KEY TAKEAWAYS

- Project profiles can be created based on **attributes** such as budget and size to determine a systematic approach to developing an execution plan and selecting a project manager.
- **Project profiling** is the process of extracting a characterization from the known **attributes** of a project.

2.2 Project Profiling Models

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVE

1. Understand different methods of typing projects.

Aaron J. Shenhar and Dov Dvir[1] developed a ***typology***—classification or profile—of projects that reflected two dimensions. The first dimension reflected the technological uncertainty and ranged from low tech, medium tech, and high tech to super high tech. Although projects involve the use of various levels of technology, Shenhar and Dvir developed criteria for each type of technological uncertainty that enabled the project to be typed. The second dimension reflected the system scope. The system scope dimension ranged from assembly projects that dealt with building a single component, to system projects that included interactive elements, to array projects that included a wide dispersal of interactive systems and subsystems.

Image by Karolina Grabowska

Shenhar and Dvir observed that the project execution approach was connected to the project type. The study identified different management patterns associated with project type as well as different management tools and practices. As the project system scope became more complex and the system scope of the project became larger, more sophisticated management tools were put in place to reduce project uncertainty. As project technology increased, project managers became more invested in processes to manage technical issues such as redesign and testing. As projects increased in system scope, project managers became more invested in formal planning and control issues. In later research, Shenhar[2] developed recommendations for adjusting the **project management** approach based on the project typology. For example, project managers will use more **risk management** techniques (see Chapter 11) when the technological uncertainty is high.

Robert Youker[3] identified basic differences in project types. Among the **attributes** he used were the uncertainty and risk, level of sophistication of the workers, the level of detail in the planning, the newness of the technology, and the time pressure. Youker also looked at project size, **duration**, geographic location, number of workers, cost, complexity, urgency, and organizational design as **attributes** that help determine a project profile.

KEY TAKEAWAYS

- There are many different typology methods to consider when characterizing a project in order to meet its specific needs and scope. Some things to consider might be technological uncertainty and complexity of scope, risk, worker sophistication, location, urgency, and organizational design.

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[1] Aaron J. Shenhar and Dov Dvir, “Toward a Typological Theory of Project Management,”Research Policy 25 (1996): 607–32.

[2] Aaron J. Shenhar, Adapting Your Project Management Style: The Key to Project Success (Hoboken, NJ: Stevens Institute of Technology, 1999).

[3] Robert Youker, “Defining the Hierarchy of Project Objectives,” IPMA Conference (Slovenia: American Society for Advancement of Project Management, 1998).

2.3 Complex Systems and the Darnall-Preston Complexity Index

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the characteristics of **complex systems**.
2. Explain the benefits of using the **Darnall-Preston Complexity Index**.

Understanding and managing **complex systems** like a project require some systems concepts that have been developed in other disciplines and applied to project management as a tool to make complex projects manageable.

COMPLEX SYSTEMS

When is a project complex? The complexity of a system is usually determined by the number of parts or activities, the degree of differentiation between the parts, and the structure of their connections. Heterogeneous and irregularly configured systems are complex, such as organisms, airplanes, and junkyards. Order is the opposite of complex. Ordered systems are homogenous and redundant, like an interstate toll booth or a production line in a factory. **Complex systems** have multiple interacting components whose collective behavior cannot be simply inferred from the behavior of the individual components.[1]

In addition to the number of parts, the degree of differentiation between parts and the number, type, and strength of relationships between parts also influences the degree of complexity. For example, the transistors in a computer have three connections to other parts of the computer, but each nerve cell in the human brain can be connected to thousands of other cells in the brain, which is why the human brain is more complex than a computer. Complexity is context dependent. A project is complex in relation to the number of activities, the type and strength of relationships to other project activities, and the degree and type of relationships to the project environment.

Projects are **complex adaptive systems**, which consist of many parts or activities that interact with each other in numerous and various ways. A **complex adaptive system** is adaptive if the activities adjust or react to the events of the environment. Successful adaptive systems adjust in a way that facilitates or allows the system or project to achieve its purpose.

The dependence of the project on the activities, the interdependence of the activities, and the specialization of the activities underscore the **relationship dependence** of project activities. This***relationship dependence*** is a key aspect of **complex adaptive systems**. The nature of **complex adaptive systems** can be probed by investigating the impact of change in one activity and the effect on other activities and the behavior of the whole. Activities must be studied and understood as interrelated, connected parts of the whole. If you remove a computer chip from a computer and the computer powers down, do not assume the purpose of the chip was to provide power to the computer. If you remove or shorten a project kickoff activity, do not assume the project will finish earlier because of the dependence of later project activities on project kickoff activities. Any change to the kickoff activities will impact other activities and the entire project.

Image by Tima Miroshnichenko

Common Core Curriculum

In 2009, the Council of Chief State and School Officers and the National Governors Association undertook the project of developing K-12 curricular standards that would be common across the adopting states. The project proved to have a level of complexity not traditionally seen in state curriculum development. The project catered to diverse **stakeholders**, including state legislatures, state departments of education, teachers, administrators, parents, colleges/universities, and businesses. The project included the creation of different committees who advised on steps in the process, requiring consensus across multiple states in different time zones with different educational values. The project complexity profile reflected the **relationship dependence** of project activities as well as the large number of interacting parts and **stakeholders** in the project.

Complex adaptive systems have three characteristics that are also reflected in complex projects.

Complex Adaptive Systems Tend to Self-Organize

Formal organizational charts indicate reporting relationships but are not very effective at displaying project relationships. Projects organize around the work, phases, or activities. The organization of the project reacts to the nature of the work at any given phase. During the start-up meeting of a large complex project, the project manager facilitated the development of the project organization chart that included all the major partners, client leaders and key team members. After the chart was complete, the project manager ripped the chart up in front of the entire project team to demonstrate his key message, which was that there are formal reporting relationships, but the real leadership and communication will change during the life of the project. In other words, the system will adapt to meet the needs of the project at each phase.

Informally, the project team reorganizes information flows and priorities to support the current work of the project and a good project manager facilitates this adaptive behavior of the project organization by minimizing the impact of formal authority and processes.

Complex Systems Adapt to Changing Environments

A ***deterministic system*** is a system that will produce the same results if you start with the same conditions. The outcome can be reliably predicted if you know the starting conditions. For example, if you fire a rifle several times at a target, the hits on the target will be closely grouped if all the initial conditions are almost identical. A **nonlinear system**, or chaotic system, can produce wildly different results even if the starting conditions are almost the same. If today's weather pattern is almost the same as it was on a previous date, the weather a week later could be entirely different. Projects are usually **nonlinear systems**. If we execute an identical complex project three different times, we will deliver three different outcomes. We start with the assumption that the project is deterministic and use scenarios and simulations to develop the most likely outcome, yet a small change such as the timing of someone's vacation or a small change in the delivery date of equipment can change the entire trajectory of a project.

Changing Environments

A design company was hired to create training for employees of the client's new enterprise. The company managers felt that the outcome would be fairly predictable and assigned the management of the project to one of their lead designers. Two weeks into the project start-up, the company president realized the project needed a manager with more expertise and assigned a new person to manage the project. Then the client informed the company that they had changed the location for their new offices from Seattle to Houston. Since they had initially wanted the training to have location-specific nuances, the project needed to be reworked. During the second month of the project, the client encountered a legal suit which necessitated that the project be placed on hold. This project environment was unstable and the project plan and organization adjusted and evolved to respond to each of these changes.

All projects experience some forms of environment shift during the life of the project. This is one of the reasons project managers develop an aggressive ***change management process***. The purpose of the **change management process** is not to stop change but to incorporate the change into the project planning and execution processes. Projects, like all other **complex adaptive systems**, must respond to the evolving environment to succeed. Plan as if the project is deterministic but be prepared for unpredictable changes.

Complex Systems Coevolve with Internal and External Changes

In addition to responding to changes in the project environment, the internal project organization and environment is in a constant state of change. New people become members of the team, people quit, retire, and get sick. The office roof starts leaking, headquarters rolls out a new computer program required for all workers, or the project's lead designer cannot get her immigration visa extended. These are real examples of events that occurred on one project, and the project team adjusted to each event. The adaptation to changes in the project's internal situation while also adapting to the external environment reflects the coevolving nature of a complex adaptive system. An increase in the number of events within the project and the project environment that are likely to change during the life of the project is reflected in an increase in the complexity of a project.

DARNALL-PRESTON COMPLEXITY INDEX

Projects are more likely to fail in the beginning, not in the end. This generalized statement reflects the importance of understanding the environment in which a project will be executed and the importance of developing an execution plan that can be successfully implemented within this environment. Profiling a project correctly requires a system that is relatively easy to use but that includes enough **attributes** to capture all the most important characteristics of a complex project. ***The Darnall-Preston Complexity Index (DPCI™)*** is one model for understanding and profiling projects (and will be explained further through the rest of this chapter). 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 provides information about the characteristics of a project that can then be addressed in the project execution plan. It achieves this **objective** by grouping eleven **attributes** into four broad categories: internal, external, technological complexity, and environmental.

The DPCI provides project **stakeholders** with information about the project to define the experience, knowledge, skills, and abilities needed by the project manager. The DPCI also has implications for the composition, organization, and skills needed by the project leadership team. The DPCI provides information and a context for developing the project execution plan and for assessing the probability of success.

Recovery costs can be extremely high for projects where the environment is misread or the execution plan does not address critical issues of the project environment. In addition to cost overruns and delays in the project, execution plans that are not aligned with the project environment can create barriers that make recovery difficult, and in some cases, the business purpose of the project cannot be met. The DPCI is a tool to assist project **stakeholders** in developing a comprehensive analysis of the project environment and a project execution plan more aligned with that environment, both of which increase the likelihood of project success.

The foundation of a sound project execution plan is an assessment of the project environment. This assessment provides the information on which the execution plan is built. In the absence of an accurate assessment of the project environment, the project leadership makes assumptions and develops the execution plan around those assumptions. The quantity and **quality** of those assumptions will significantly influence the effectiveness of the project execution plan. The amount of information available to the project manager will increase over time and assumptions will be replaced with better information and better estimates. As better tools are developed for evaluating the project environment, better information will become available to the project manager.

The project environment includes all the conditions that can influence the outcome or success of the project, such as the project size, technological complexity, cultural and language barriers, the political landscape, and resource constraints. Understanding these influences and developing a project profile creates a foundation for building an effective project execution plan.

KEY TAKEAWAYS

- **Complex systems** have many different parts that interact with each other in different and often unpredictable ways. They adapt to changes in their external and internal environments.
- The **Darnall-Preston Complexity Index (DPCI)** assesses project **attributes**, enabling better-informed decisions in creating the project profile.

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[1] Stephen Jay Gould, Full House: The Spread of Excellence from Plato to Darwin (New York: Three Rivers Press, 1996).

2.4 Darnall-Preston Complexity Index Structure

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe each of the **external attributes** that contribute to project complexity.
2. Describe each of the **internal attributes** that contribute to project complexity.
3. Describe each of the technological attributes that contribute to project complexity.
4. Describe each of the environmental attributes that contribute to project complexity.

The **Darnall-Preston Complexity Index (DPCI™)** is designed to develop a project profile that reflects different aspects of the project that will influence the approach to leading and executing the project.

The DPCI is built on four categories of **attributes**:

1. External. Environmental attributes that are in existence at the beginning of the project, such as size, **duration**, and available **resources**
2. Internal. Clarity of project objectives, the clarity of scope, the organizational complexity, and stakeholder agreement
3. Technological. Newness of the technology and familiarity of team members with the technology
4. Environmental. Legal, cultural, political, and ecological

The DPCI was developed around four assumptions:

1. All projects are unique.
2. Projects have common characteristics.
3. These characteristics can be grouped together to create a project profile.
4. There is an optimum execution approach for each project profile and therefore an optimum set of skills and experience for the project manager and execution team.

EXTERNAL ATTRIBUTES

The***external attributes*** include those issues that are typically established early in the project definition phase and are usually outside the direct control of the project management team. The project size can be a product of the dollars needed to execute the project or project cost. The cost of the project is estimated during the conceptual phase of the project and is established at the time the project is authorized. The **duration** or time allocated to complete the project and the **resources** available are also **attributes** that are established when the project is authorized.

Size

Project size is a relative concept. How do we decide if something is large or small? A 150-pound person is big if the person is ten years old. A 150-pound person is small if the person is a professional football lineman. The frame of reference provides the context in which size is determined.

The size of a project is also relative. A $250 million oil refinery expansion is a relatively small project in an industry where billion-dollar projects are common. A $250 million pharmaceutical development project or software development project would be considered a large project. The size of a project is determined by the context of the industry and the experience of the team executing the project.

Design firms usually specialize in projects that fall within a defined range. Small firms usually execute small projects and large firms usually execute larger projects. There is a size range for which the company experience, management skills, tools, and work processes are primarily designed. This size range or comfort zone exists for both the company and the members of the project team executing the project.

When a project team executes a project outside their comfort zone, stress is placed on both the tools and project team. When a project is larger than the comfort zone of a company, stresses are placed on the ability to provide experience and appropriate work processes, and the results are typically cost overruns and schedule delays. To mitigate this stress, some companies will divide large projects into smaller projects and execute the smaller projects with separate dedicated staff and **resources**. The key to success then becomes the coordination of the small projects to behave as if they are one large project.

When a company is executing a project that is much smaller than the company norm, **resources** are often misused and inappropriate work processes are utilized. The result often increases the project costs. Some companies with a history of executing large projects have set up a small project group to execute smaller projects. These groups establish a different **culture**, develop appropriate work processes, and use tools designed to execute smaller projects.

The more the project size is outside the comfort zone of the project, the more stress is created for the project. This is true on both ends of the spectrum. Both smaller and larger projects that fall outside the comfort zone of the project management team will create stress for the project. New skills, tools, and processes will need to be developed to manage the project, and this activity will absorb management time and energy. The higher the stress level created by executing a project outside the comfort zone of the organization, the greater the impact on the complexity level of the project.

Duration

The **duration** of a project is often set by the parent organization that charters the project with a deadline that reflects the business purpose of the project. The following are examples of projects with end dates that are established to meet the organization's business purpose:

- A new software program for a university to be implemented in time for registering students in the fall
- A new product to be introduced to the marketplace at the industry's major conference
- A new high school to be constructed and open next fall

The project team also estimates the **duration** of the project and establishes a project end date based on normal work (e.g., forty hours per week) and the availability of **resources**.

Sometimes the normal time needed to complete a project is longer than the time available.

College Accreditation

A university's college of nursing is working to develop an assessment system to measure learning outcomes as part of its efforts to meet accreditation requirements. The deadline is six weeks earlier than the time estimated to pilot, revise, and finalize the assessment system. New employees will have to be hired to complete the additional work needed and professors will be asked to use small chunks of instructional time to expedite the piloting of items. A new schedule is developed based on these changes to the execution approach, and now the project schedule has zero float.

The result of this six-week compression to the project schedule is additional stress on the project. Significant management time and energy will be invested in tracking and managing schedule issues. Every issue that arises will need to be resolved quickly and involve the project's senior manager to assure the project schedule does not slip. This additional stress increases the overall project complexity.

Resource Availability

Projects require both human and tangible **resources**. The project requires people with the right experience, knowledge, and skills to accomplish the assigned tasks. Some projects require specialized subcontractors with skills not found within the project team. Each of these **resources** required by the project will be needed at the point in the project schedule when the materials or skills are required. When these **resources** are scarce or not available, additional management time and energy are needed.

Criterion-Referenced Tests

When the United States Congress authorized the No Child Left Behind Act, states were required to develop large-scale assessments to measure how well students were performing according to the new standards. With many states trying to hire measurement experts to help develop these tests, a project manager for one state's implementation found that experts in testing and measurement were in short supply. The project manager dedicated significant time and **resources** to train people from within the project in educational assessment and measurement principles so that the project of test development could continue.

When **resources** needed to execute the project are not readily available, the project leadership dedicates more management time and energy to acquiring the **resources** or finding innovative solutions to accomplish the project goals without the needed **resources** or with creative alternative solutions. The more time and energy the management team must dedicate to searching for **resources** or alternatives, the more stress on the project. The more scarce and more important the **resources**, the more stress is placed on the project.

INTERNAL ATTRIBUTES

The***internal attributes*** are within the control or influence of the project manager, such as the clarity of objectives, clarity of scope, organizational complexity, and stakeholder agreement. Although the clarity of objectives, as with the other **attributes**, can be improved during the life of the project, the project profile reflects the project at a given time. If the project objectives are not clear during the evaluation of the project, this lack of clarity impacts the complexity of the project.

Clarity of the Project Objectives

Project decisions are made based on how these decisions help the project meet its objectives. If the objectives are unclear, the team will not make the best decisions. The greater the confusion for the project team on the goals and objectives of the project, the greater the impact on the complexity of the project.

Confusion Over Objectives in Philadelphia

A consultant was asked to evaluate the likelihood of the success of a large project in Philadelphia. The consultant interviewed the project leadership and asked if the goals of the projects were clear. Each member of the leadership team responded that the goals and objectives were clear; however, when asked what the goals were, the answers varied greatly.

Protected

An educational evaluation project involved collecting outcome data from a large number of college students. The Institutional Review Board (IRB) application stated very clearly that individual students would not be identified with the data collected, that every effort would be made to make data generation and collection non-intrusive for students, and that students would not lose instructional time. Every major data decision passed through an evaluation of the impact on student instructional time and the protection of student confidentiality. Although these steps increased the complexity of the project, the clear goals warranted the extra efforts.

Clarity of Scope

The ***project scope*** defines what is inside the project and what is outside. Does the project to train five hundred technicians for the Boeing 787 include recruiting and assessing potential employees? The project scope did include recruitment and assessment, but hiring processes and drug testing belonged to Boeing. This scope was clear about which responsibilities belonged to the contractor doing the training and which responsibilities belonged to the parent organization.

Not all project scopes are this clear. The development of a clear project scope depends on the information available about what products and services will be required. A project to develop a vaccine for a new strain of flu may not include sufficient information to develop the processes the team will utilize to understand the flu virus and develop a vaccine. As the team develops more information, the scope can be further developed.

Leadership time and energy will be focused on developing scope clarity. The lack of clarity and the amount of time needed by the leadership team to develop a clear scope will add to the project complexity.

Organizational Complexity

The structure of the project's client organization and the organizational decision-making processes influence the project complexity. A project with one client as the central point for making decisions and providing client approvals and technical information has only one relationship to manage and a streamlined communication process. Projects with a team representing the client require more of the project manager's time and energy managing the client relationships and communication process. The client team approach brings more expertise and often more comprehensive project oversight, but it adds to the project complexity.

Stakeholder Agreement

Often there is more than one major stakeholder in the project. An increase in the number of **stakeholders** adds stress to the project and influences the project's complexity level. The business or emotional investment of the stakeholder in the project and the ability of the stakeholder to influence the project outcomes or execution approach will also influence the stakeholder complexity of the project. In addition to the number of **stakeholders** and their level of investment, the degree to which the project **stakeholders** agree or disagree also influences the complexity of the project.

A small educational project will typically have several **stakeholders** in addition to the client. School administrators, teachers, students, parents, and even community and business leaders may have an interest in the project and can influence the execution plan of the project. The number of **stakeholders** on the project, multiplied by their passion for the subject and the potential for disagreement, increases the complexity of the project. Significant time and **resources** of the project will be dedicated to identifying, understanding, and managing expectations.

TECHNOLOGICAL COMPLEXITY

The technology of a project refers to the product of the project and not the technology used to manage the project. This technology is typically unique to the industry. A pharmaceutical project technology is a drug-making technology or pharmacology. The technology for a project to build a new automobile plant is the car production process. The key stress on the project is the newness of the technology. What aspects of the technology are known, and what aspects are unknown? Does the project combine technologies on the project that have never been combined? Newer and more complex technology requires greater expertise on the project team and increases the stress and complexity of the project.

Open Assessment Project

A non-profit organization hired a project manager to oversee the development of a website to distribute openly-licensed assessment items for teachers. The project required building an interface that would allow teachers to access materials and receive training on how to write good items, have a mechanism for teachers to submit new items, and a way for teachers to give tests online so student data could be used to evaluate the strength of individual items. Most of the technology was tested and the project team brought in experts to help design and implement an interface to meet the requirements of the project. The technology of the project necessitated the project team to develop a new understanding of this technology and adapt work processes to the technical requirements.

Project Environment

The **project environment** includes all the issues related to the environment that will influence the development and execution of the project plan. An instructional design project in Pittsburgh, Pennsylvania will have very different legal, cultural, and political issues to address from one in São Paolo, Brazil. The environment attributes in Brazil require more planning, **resources**, and leadership attention to successfully execute the project.

Legal

The legal issues on a project can be broad and include many different levels of government. Most local governments have various permits, such as business licenses and building permits, required to do work. Some projects will have security issues and will work with local law enforcement.

Workforce laws vary significantly in country, regional, and local jurisdictions. The hiring and management of workers can be a complex and time-consuming issue for some projects. Companies not used to working in a union environment will invest project **resources** in learning and adapting to the new environment. Scheduling holidays, supporting maternity leave, and dealing with workforce reduction issues surrounding project closeout will vary in each environment, industry, and project. Understanding and managing workforce issues on a project can be simple or very complex.

National, regional, and local taxes require a project tax approach or policy on most international projects and some domestic projects. Duties for equipment and material brought into a country add complexity to the procurement plan. Equipment used temporarily to execute the project, such as a crane, is treated differently than permanently installed equipment, such as a pump. In some countries, a third party is hired to expedite the flow of materials through complex custom processes.

Not every project will have significant legal issues. When legal issues are involved, they are typically significant and will add to the complexity of the project. Understanding the legal issues that can affect the project and developing a plan to address these issues will reduce the complexity of the project.

Cultural

Culture is a term that reflects the community's assumptions, norms, values, and artifacts. Community includes the parent organization charting the project, the local community or communities where the project is executed, and the region and country where the project is located. The project team must understand the community's **culture** and its potential impact on the project. **Culture** also defines the meaning of work, truth, relationships, and how to communicate. Projects executed in various cultures will often experience cultural conflict.

Gender Difficulties in Argentina

A project team from the United States was responsible for executing a project in Argentina. The U.S. leadership team included women in key leadership positions, and the Argentines refused to take direction from females. The U.S. team believed strongly in their leadership capability and refused to make changes. This conflict was settled by senior managers of both organizations, and rules were established that respected all team members in leadership roles. The conflict did not go away, but the team was able to successfully execute the project with the original team. Delays were experienced on the project that could be traced to this cultural conflict.

Many organizations have rule-based cultures. Institutions of higher learning, organizations related to judicial organizations, and most government organizations are examples of rule-based organizations. The organizational structure and **culture** inhibit risk-taking through established rules and policies. Projects are goal based and focus on plans and processes to achieve goals. Goal-based cultures promote assuming risk to achieve goals. Projects that are closely tied to a rule-based parent organization will often find conflict with the parent organization's need to follow rules and the project's need to accomplish goals. This conflict creates additional stress that adds to the project complexity.

On global projects, language, cultural conflict with the role of women, the religious role in daily activities, and even the concept of time can become issues on the project. These issues require project leadership to resolve and they add to the project complexity. In some countries and even different companies in the same country, meetings start on time, and a person arriving five minutes late will cause major disruption. In other situations, meetings can start within thirty minutes of the starting time without anyone objecting.

Communication Problem in India

A team of project experts was sent to India to evaluate a large instructional design project. The team arrived and reviewed the project documents which reported that the project was on time and meeting all project goals. After spending three days with various designers and team managers, the team discovered the project was significantly behind schedule. A **culture** existed on the project where workers told the project management what they expected to hear, and the difference between the progress of the project team and the progress reports became so large that the difference could not be reconciled during the original schedule of the project.

An increase in the number of cultures represented on the project team raises the cultural complexity and the complexity of a project. Although this cultural diversity creates leadership challenges, it also presents opportunities. The diversity of cultures presents various approaches to solving problems, and the project manager may find innovative solutions easier to develop with a diverse project team.

Political

Every project operates within one or more communities that reflect organizational dynamics and power struggles. The more important the project is to the organizational leadership, the more invested various organizational leaders will be in the project. The more people that become invested in the project and the more influence these people exhibit on the **resources** and activities of the project, the more time and energy will be expended by the project team in managing these outside influences. This additional stress on project leadership time and **resources** adds complexity to the project.

Ecological

Projects have the potential to impact the living conditions or the health of people, plants, and animals. In addition to the potential impact to land, water, and air, the ecology includes the sights and sounds that can impact the **quality** of life. An increasing number of clients expect the project team to minimize the impact of the project on the ecology. An ecology that is more sensitive to disruption and more disruptive technology will place greater stress on the project and increase the project complexity. The addition of twenty-five people in existing office space or one that requires a substantial increase in electrical use will all impact the ecology. The project team develops means and methods to minimize the impact of the disruption in a manner consistent with the requirements as communicated by the client. The effort that is needed to minimize the ecological impact will influence the complexity of the project.

KEY TAKEAWAYS

- The **external attributes** are the relative size of the project, **duration** of the project, and the available **resources**.
- The **internal attributes** are the clarity of its scope, the complexity of the organization, and the agreement among **stakeholders**.
- The technological attributes are the technology of the product (not the technology used to manage the project), the newness of the technology, and the familiarity of the team with the technology.
- The environmental attributes are the legal issues, cultural conflicts, political interests, the impact of the project on the ecology, and the impact of the ecology on the project.

2.5 Using the Darnall-Preston Complexity Index to Measure Organizational Complexity

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVE

1. Analyze a project function for size, organizational complexity, technological newness, and technological familiarity and assign a complexity score.

Recall that the **Darnall-Preston Complexity Index (DPCI™)** ranks complexity in four categories: external, internal, technological, and environmental. The information provided in this chapter can be used to rate a project's complexity in the areas of size, organizational complexity, technological newness, and technology familiarity. Scores range from 1 (least complex) to 5 (most complex).

Image by William Fortunato

Size

Recall that size is relative to the organization's comfort zone for projects. Refer to the following descriptions for tips on arriving at a DPCI score for size:

1. The project size is the most common size the organization does. The project manager and team members have done many similarly sized projects, and the tools they use to manage this size project are well tested and reliable.
2. The project size is at the high or low end of the range of project sizes that the organization or team members have done before.
3. The project size is about 20% higher or lower than projects the organization or some of the team members have done before. The project leader and a few key team leaders are familiar with this size project from work they have done

elsewhere. Project management tools and processes will have to be adjusted but will probably work.
4. The project size is about 50% higher or lower than projects the organization or most of the team members have done before. Project management tools and processes will have to be adjusted, and it is not certain that they will work well. New tools and procedures may be needed.
5. Neither the organization nor the team members are experienced working on a project this size. It is several times larger or smaller than previous projects. It is too small or too large for the tools and techniques with which the team is familiar.

Organizational Complexity

Recall that system complexity is determined by the variety of types of elements and the number of connections there are between elements. Review a chart of the organizational structure that depicts the reporting relationships, the number of people involved, their familiarity with each other, and the number of cross-connections between reporting relationships and functions. Refer to the following descriptions for tips on arriving at a DPCI score for size:

1. The organizational structure is simple and involves few people. No new relationships need to be formed, and the people have worked together in these relationships before.
2. The team includes people who report to **operations managers** instead of the project manager, and more people are involved.
3. The organization chart has numerous segments, but most people are familiar with their roles and have worked in this type of role before.
4. The number of people involved is large, and the functions are handled by many different people. There are several levels of reporting in the organization chart.
5. The number of people is very large, and many of them do not know each other or have never met. Each major function requires a full-time person, and coordinating between functions requires frequent meetings among mid- and top-level managers.

Technology Newness

Recall that this category refers to the technology that is part of the project. It might be new technology that is being implemented to make a step-change in the efficiency of an operation. Refer to the following descriptions for tips on arriving at a DPCI score for size:

1. The technology is not new. It has been around for years and is reliable.
2. The technology is only a few years old. Most of the initial bugs are out of it, but the fixes have not been thoroughly tested.
3. The technology is recent, and only a few other organizations have experience with it. The providers promise that the next release or version will have the problems resolved.
4. The technology is new and has just been released for general use. Problems are likely.
5. The technology is in an early testing phase, and your organization is one of the test sites. Problems are expected.

Technology Familiarity

Recall that this category refers to the familiarity of the project team with the technology that is part of the project. Refer to the following descriptions for tips on arriving at a DPCI score for size:

1. The team members have all used the technology or have been involved with projects that used this technology. They are confident that they understand it and can handle problems related to it.
2. The technology is new to some of the team members who are not in key positions. Standardized training is available, if necessary, to teach them what they need to know about it to do their jobs.
3. Several team members have not worked with this technology, including some of the key team members. Standardized training is not available, and consultants might be needed.
4. The technology is new but is similar to previous technologies with which the team leaders are familiar. An advisor from

the product's development team may serve as a technology advisor.
5. The technology is new, and no one has worked with it before. A specialist might be needed to avoid serious errors.

Assigning a Score

Assigning a score is not an absolutely accurate process. Your **objective** is to be approximately correct, and some people are not comfortable with this type of **estimate**. Recall that one of the **attributes** of a successful project manager is the ability to live with ambiguity. One method that will help when assigning a score is to consider the two extremes. For each factor in the DPCI, consider what the simplest—least complex—scenario would look like, to which you would assign a 1 on the DPCI scale. Next consider what the most complex scenario would be, which would describe a 5. Then, compare actual projects to those two extremes. Accordingly, if it is about in the middle it rates a 3, and a 2 and a 4 are moderately simple and moderately complex, respectively.

KEY TAKEAWAYS

- Scores range from 1 to 5, where 1 is the lowest level of complexity and 5 is the highest. In each situation, consider what the two extremes would look like and then judge where the current situation lies between those extremes.

2.6 Instructional Design Case Study

Project Profiling: Case Study

Effective project management relies on a thorough understanding of the project. An effective method to better understand a project is to create a project profile. Creating a project profile will help identify the characteristics of the project, identify the project scope, prevent project scope creep, identify required technology, and help in developing an appropriate action plan and timeline to complete the project. But what happens when a project is started without conducting a thorough project profile? Read the scenario below and consider how creating a project profile could have helped Francine with her renovations.

Francine has recently purchased an older house in her hometown of Saskatoon, Saskatchewan, with the purpose of renovating it. Francine has extensive experience in construction as she worked with various local construction companies during her summers off from university.

Francine decides she is going to renovate her kitchen. She begins by purchasing new cabinets and removing the old kitchen cabinets. She then realizes that the new cabinets do not match with the old countertops, so she decides to remove them. Once the old countertops have been removed, she notices that the floor around the sink is water-damaged. Francine realizes that there are issues with the plumbing and that she will need to call a certified plumber to complete the required work. The plumber reports back to Francine that there are many issues with the plumbing in her house and that the project is larger than she expected. She will also need to replace a section of the floor in the kitchen as the water damage was quite extensive. This means she will also need to replace the kitchen tiles. Francine comes to the unfortunate realization that the renovations she desires to complete are much too extensive, expensive, and complex for her to complete herself.

Francine begins to calculate the amount of money she has invested and the projected costs of fixing the plumbing, floor, and new kitchen floor tiles. She now realizes that she is over her budget and this renovation will take much longer than expected while requiring an expertise that she does not have.

In this scenario, what prior steps could Francine have taken to ensure that the project would meet her timeline, budget, and still be within her construction expertise?

CHAPTER 3

3 Project Phases and Organization

3.0 Overview

Visit Audio Recordings for the audio version of this section.

This chapter provides an overview of the entire **project management** process and applies to all the questions in the CAPM and PMP. However, it aligns well with Chapter 2 of the PMBOK and 4% of the CAPM is specifically dedicated to project life cycle and organization.

This chapter outlines the possible project organizational structures (both in terms of staff roles and communication channels) as the project progresses through its phases, from initiation to closeout.

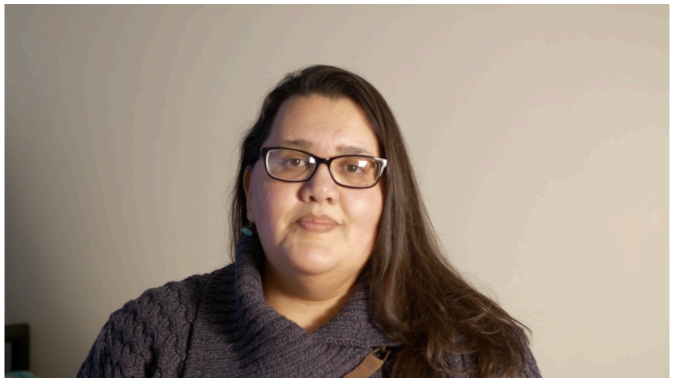
Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=52

I think we find the bailout points, the segments of a project, and places where we have a fail-safe, where we can pull out, or we need to go to the very end on it. It happens very early in the project, it has to happen then. Now, I usually have a feel for that after negotiating ideas with clients. Click here to access transcript.

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan



When I'm designing an online course with a subject matter expert, I try to follow the ADDIE instructional design model. So when I start designing an online course, with an instructor, we usually have a kick start meeting with a department head, the instructor and then my manager so that we can all agree on what the terms of the project would be. Click here to access transcript.

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

Well this turned out to be an interesting team. I was–this was my second project–training helicopter pilots and sensor operators and working with a very large client. This was my second project after graduate school. I had only been in the field for a year as a designer. The team ended up being about twenty, twenty-five people by the time we were through. The kinds of people that I worked with were first of all, subject matter experts who were given to us by the customer, which was the Navy. We also had–on our team we had–I had an assistant designer who was not trained, but was experienced. And was a former member of the Navy, and that really helped a lot because he understood the context that we were working with, and he understood the personalities. He frequently had to save us from peril. I mean, here is this fresh out-of-the-can instructional designer out of college, inexperienced in the ways of the world, and this guy–guy named Bob Hoffman saved my bacon a lot of times. We had other people. I had an assistant instructional designer who was a good writer, served writing functions. We had a video producer, because we had to produce twenty video segments while we were doing this. I had a host of artists. We had a very large art shop it turns out. There were different varieties of artists. We had a cartoonist, a guy named Johnny Hawk, who was very good. We had a serious technical–straight lines–you know with straight edge and everything. We had one of those. We had, one of the categories that we had that was very interesting to work with was what were called paste-up artists. In those days we didn't have desktop publishing at all. I mean, a word processor was still a Wang machine that came as a thing that sat beside your desk, it was huge. We didn't have, we couldn't create, design the layouts. And so they would have to use a special processor called a compositor to print out on glossy certain kind of paper, the text that was going to be placed on a page. And these paste-up artists would have to come with their X-ACTO knives and their straight edges, and cut out a piece of text and glue it to the piece of paper. It was a really interesting process. Nothing in my training in college told me that there was this kind of a person. And yet I end up, or any of these kinds of categories of artists, and yet within a year after college I was managing a host of these people. It was a very interesting experience.

Heather Bryce – Independent Studies – BYU

Okay, well, we have editors. So we have fulltime employees and student employees. Our full-time employees kind of oversee the different functions. We have an editing function. The editing supervisor supervises student editors who take a first take and a second take on the courses. We also have a video supervisor who supervises our videographers. We have a flash supervisor, who supervises the flash programmers. So, and then, obviously an art director who supervises the artists. What I do as a project manager–I meet with the instructional designer and the different supervisors of those departments. And we meet at the beginning of a course and discuss what all the requirements will be for the course and collaborate. If there is an idea where originally the instructional designer thought that it would be good as a video piece, as we talk and meet perhaps the flash supervisor would have a better idea of how to best present it instructionally for the student. Something more interactive than just watching a video. So that's how the roles are divided.

Dr. Larry Seawright – Center for Teaching and Learning – BYU

In a project like the BYU Learning Suite project, which is a learning content management system, there are quite a few roles that are encompassed in that–in the development process alone, not to mention everything else. In the needs gathering phase of that we have consultants who contribute to, along with the instructional designers, the building of the design of what we're going to produce. We have programmers who have to weigh in and say whether or not that is feasible. We have graphic designers who say "Gee if we have this kind of a format, then we're going to have to do this with the layout", and that kind of constricts us. Going back again to the stakeholders we have faculty and students weighing in all along the way. And then of course we have the University administration giving us mandates. You have to do this and you have to do that. So the various roles as a project manager, you have to balance all those competing interests, and try to weigh, you know, when you get a mandate you have to weigh it against the realities of what you can do with the time, the scope, the money that you have. And then you take the resources, the people, the expertise that they have, and try to match it against all of those different competing agenda items. And you come up with a plan, and you try to execute against the plan.

3.1 Project Phases and Organization

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify the phases of a project.
2. Describe the types of activities in each phase of a project.

Projects, by definition, have a beginning and an end. They also have defined phases between the project kickoff and project closeout. A phase represents a grouping of similar activities that has a very loosely defined beginning and end. Phases are typically sequential, where the prior phase is essentially complete before the beginning of the next phase; however, phases do not have clear-cut end dates and some activities in an early phase of the project will continue into the later phases. This is in contrast to project beginning and ending dates and milestone dates, which do have clearly defined dates with the expectation that these dates will be met.

The Project Management Institute (PMI) identifies four major phases of a project as characteristics of the project life cycle.[1] These four life-cycle phases are initiation, planning, execution, and project closeout. The knowledge, skills, and experience needed on the project can vary in each phase. During the early phases of a project, the project leadership needs good conceptual skills, the ability to build a team, and the experience to build a project roadmap. During project closeout, the project leadership provides a high degree of motivation and attention to detail. On a large project, lasting two or more years, it is common to see the project management team change leadership to provide skills that are appropriate to the final phases of the project.

Initiation

The ***initiation phase***, which PMI labels "starting the project," includes all the activities necessary to begin planning the project. The **initiation phase** typically begins with the assignment of the project manager and ends when the project team has sufficient information to begin developing a detailed schedule and budget. Activities during the **initiation phase** include project kickoff meetings, identifying the project team, developing the **resources** needed to develop the project plan, and identifying and acquiring the project management infrastructure (space, computers). On projects where the scope of work for the project is not well defined, the project team will invest time and **resources** in developing a clearer scope of work. On projects where the major project **stakeholders** are not aligned, the project team will expend **resources** and time creating stakeholder alignment.

Unlike project **milestones**, some activities associated with project initiation may be delayed without delaying the end of the project. For example, it is advantageous for the project to have the major project **stakeholders** aligned from the beginning, but sometimes it is difficult to get the commitment from **stakeholders** to invest the time and **resources** to engage in an **alignment process**. Sometimes it is only after stakeholders begin observing progress on a project that the project manager can facilitate the **stakeholder** alignment processes.

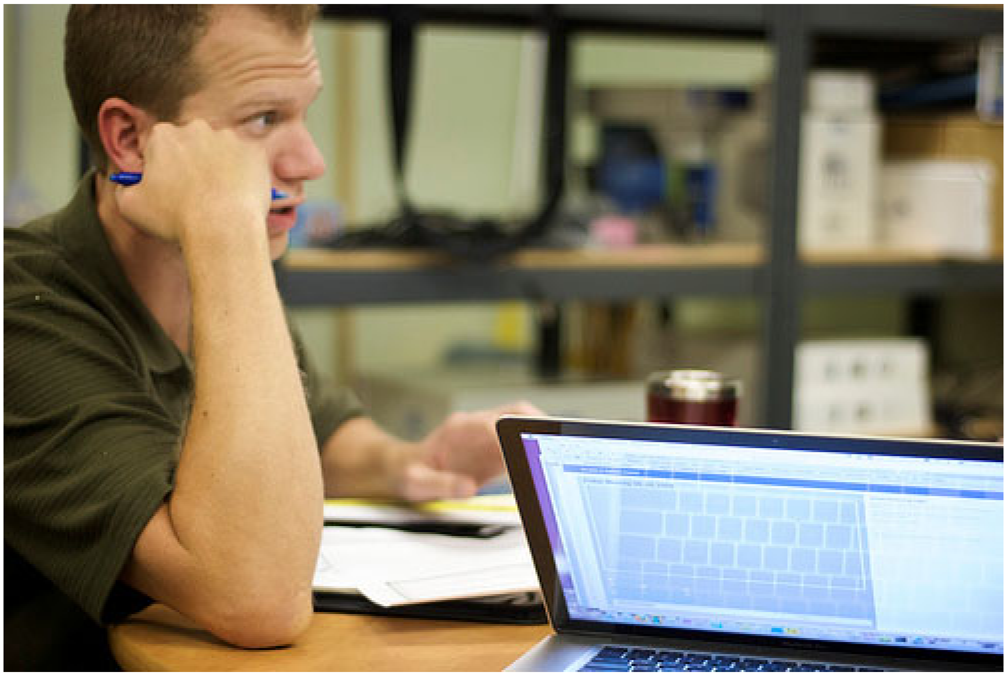


Image by iChris

Planning

The **planning phase**, which PMI labels "organizing and preparing," includes the development of more detailed schedules and a budget. The planning also includes developing detailed staffing, procurement, and project controls plans. The emphasis of the **planning phase** is to develop an understanding of how the project will be executed and a plan for acquiring the **resources** needed to execute it. Although much of the planning activity takes place during the **planning phase**, the project plan will continue to be adjusted to respond to new challenges and opportunities. Planning activities occur during the entire life of the project.

Execution

The ***execution phase***, labelled by PMI as "carrying out the work," includes the major activities needed to accomplish the work of the project. On a construction project, this would include the design and construction activities. On an information technology (IT) project, this would include the development of the software code. On a training project, this would include the development and delivery of the training.

Closeout

The ***closeout phase***—or using PMI's nomenclature, "closing of the project"—represents the final stage of a project. Project staff is transferred off the project, project documents are archived, and the final few items or **punch list** is completed. The project client takes control of the product of the project, and the project office is closed down.

The amount of **resources** and the skills needed to implement each phase of the project depends on the project profile. Typically, a project with a higher-complexity profile requires more skills and **resources** during the **initiation phase**. Projects with a profile that indicates problems with alignment among key **stakeholders** or political and legal issues will require specialized **resources** to develop plans that address these issues early in the project. A project with a lower complexity level will invest more **resources** in the **execution phase** to complete the project as effectively and efficiently as possible.

Image by Ignacio Amenabar

Project Phases on a Large Multinational Project

A United States instructional design company won a contract to design and build the first distance-learning-based college campus in northern Argentina. There was no existing infrastructure for either the educational or large internet-based projects in this part of South America. During the **initiation phase** of the project, the project manager focused on defining and finding a project leadership team with the knowledge, skills, and experience to manage a large complex project in a remote area of the globe. The project team set up three offices. One was in Chile, where a large distance education project infrastructure existed. The other two were in Argentina. One was in Buenos Aries to establish relationships and Argentinean expertise, and the second was in Catamarca—the largest town close to the campus site. With offices in place, the project start-up team began developing procedures for getting work done, acquiring the appropriate permits, and developing relationships with Chilean and Argentine partners.

During the **planning phase**, the project team developed an integrated project schedule that coordinated the activities of the design, procurement, and design teams. The project controls team also developed a detailed budget that enabled the project team to track project expenditures against the expected expenses. The project design team built on the conceptual design and developed detailed drawings for use by the procurement team. The procurement team used the drawings to begin ordering equipment and materials for the implementation team to develop labour projections, refine the construction schedule, and set up the campus site.

The **execution phase** represents the work done to meet the requirements of the scope of work and fulfill the charter. During the **execution phase**, the project team accomplished the work defined in the plan and made adjustments when the project factors changed. Equipment and materials were delivered to the worksite, labour was hired and trained, a learning center site was built, and all the development activities, from the arrival of the first computer to the installation of the final light switch, were accomplished.

The **closeout phase** included turning over the newly constructed campus to the operations team of the client. A **punch list** of a few remaining items was developed and those items completed. The office in Catamarca was closed, the office in Buenos Aires archived all the project documents, and the Chilean office was already working on the next project. The accounting books were reconciled and closed, final reports were written and distributed, and the project manager started on a new project.

KEY TAKEAWAYS

- The phases of a project are initiation, planning, execution, and closeout.
- The **initiation phase**, which PMI calls "starting the project," includes activities such as holding alignment and kickoff meetings, identifying the project team, developing the **resources** needed to develop the project plan, and identifying and acquiring the project management infrastructure.
- The **planning phase**, which PMI calls "organizing and preparing," includes developing detailed staffing, procurement, and project controls plans.
- The **execution phase**, which PMI calls "carrying out the work," includes the major activities needed to accomplish the work of the project.
- The **closeout phase**, which PMI calls "closing of the project," includes transferring staff, archiving documents, closing offices, completing **punch list** tasks, and turning over the results of the project to the client.

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[1] Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008), 11–16.

3.2 Project Phases and Organization

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify the various functions represented on a project.
2. Analyze and evaluate the influence of organizational structure on project functions.
3. Design a project organizational chart for various project complexity profiles.

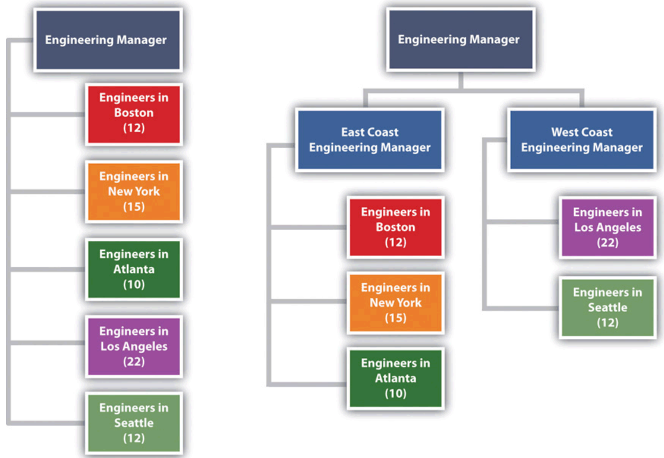
There is no single organizational approach to projects. Each project is organized to accomplish the work effectively and efficiently. Several factors influence the organizational approach to execute a project. The complexity profile of a project, the **culture** of the parent organization, the preferences of the project manager, the knowledge and skills of the team, and whether the **project management** office is in-house or outsourced are some factors that influence the project's organization.

Image by Mimi Thian

In developing the project organizational structure, the project manager considers the **span of control** for each manager. The **span of control** represents the number of people reporting to a manager. For example, the project manager does not want all of the artists on a project reporting to the art director and assigns lead artists to report to the art director with groups of artists who work on particular aspects of the design reporting to their group's lead artists.

The art director can organize the art department reporting structure so that the various lead artists would report to him or her. For example, the lead artists for various aspects of an instructional design project would report to the art director. On a larger, more complex project, the art director may establish area team leaders and have the art leads for each area report to an area art lead. If the project is geographically dispersed, with areas of the art department in different cities working on the project, then structuring the art function by area provides better coordination and control (see Figure 3.1).

Figure 3.1 Decreasing **Span of Control** by Increasing Levels of Reporting

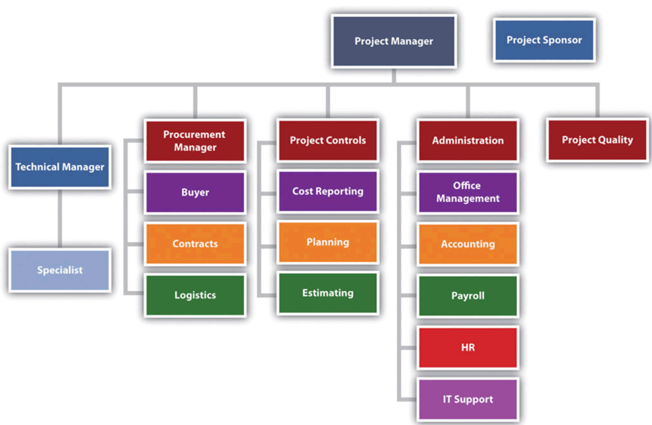


The organization on the left has seventy-one artists reporting to the same person. The organization on the right creates two additional positions and reduces the **span of control** to thirty-seven and thirty-four, respectively.

Most projects have similar functions that are important to successfully manage the project. Included among these are the following:

- Sponsor
- Project manager
- Controls
- Procurement
- **Technical management**
- **Quality**
- Administration

Figure 3.2 Typical Project Organization



On smaller projects, more than one function can be managed by one person. On larger projects, large teams may be needed to accomplish the work within the function.

Project Sponsor

The **project sponsor** is outside the day-to-day operations of the project and has the organizational authority to provide **resources** and overcome barriers for the project. The **project sponsor** is typically a leader in the parent organization with an interest in the outcome of the project. As a leader in the parent organization, the **project sponsor** can provide input into the **project scope** and other documents that define project success. The guidance and support from the **project sponsor** enhances the ability of the project to successfully meet the parent organization's **objective**s.

Southern Training Center Organization

A training organization in South Carolina assigned a **project sponsor** to every project. For smaller projects, the regional manager fulfilled the role of the **project sponsor**. On larger, more complex projects, the **operations manager** was the **project sponsor**. The vice president was the **project sponsor** of the three or four most complex projects, and the president was the **project sponsor** only on projects with a high degree of political risk. This approach to assigning **project sponsors** assured that each project had an organizational advocate that could address barriers and provide direction and **resources**. The **project sponsor**, in this organization, developed a relationship with a senior representative of the client organization, reviewed monthly reports, and conducted thorough quarterly reviews.

Project Manager

Project managers often have the breadth of responsibility associated with corporate chief executive officers (CEOs). The project manager facilitates the start-up of a project and develops the staff, **resources**, and work processes to accomplish the work of the project. He or she manages the project effectively and efficiently and oversees the **closeout phase**. Some projects are larger than major divisions of some organizations, with the project manager responsible for a larger budget and managing more risk than most of the organizational leaders. A mining company that builds a new mine in South Africa, an automobile manufacturer that creates a new truck design, and a pharmaceutical company that moves a new drug from testing to production are examples of projects that may consume more **resources** in a given year than any of the organization's operating divisions.

The function of the project manager can vary depending on the complexity profile and the organizational structure. Defining and managing client expectations and start-up activities, developing the scope, and managing change are functions of the project manager. On some projects, the project manager may provide direction to the technical team on the project. On other projects, the technical leadership might come from the technical division of the parent organization.

Although the functional responsibilities of the project manager may vary, the primary role is consistent on every project. The primary role of the project manager is to lead, to provide a vision of success, to connect everyone involved in the project to that vision, and to provide the means and methods to achieve success. The project manager creates a goal-directed and time-focused **project culture**. The project manager provides leadership.

Project Control

In general, **project control** is both the planning function and the function that tracks progress against the plan. **Project control** provides critical information to all the other functions of the project and works closely with the project manager to evaluate the cost and schedule impact of various options during the life of a project.

Sometimes accounting functions such as payroll, budgeting, and cash management are included within **project controls**. On larger projects, accounting functions are typically separate because the accounting **culture** tracks expenses to the nearest penny, and cost estimating and tracking by **project controls** can often be off by hundreds and sometimes thousands of dollars. The lack of definitive information necessitates the development of cost estimates within ranges that are often inconsistent with accounting practices. Separating these two functions allows each to operate within their own accuracy comfort zone. The following are typical activities included within the **project controls** function:

- Estimating

- Tracking costs
- Analyzing trends and making projections
- Planning and scheduling
- Managing change
- Tracking progress against schedule

The project control team gathers this information from all the functions on the project and develops reports that enable each functional manager to understand the project plan and progress against the plan at both the project level and the functional level. On large complex projects, some project managers will assign project control professionals to work within the major functions as well as the **project management** office. This approach allows each function to plan and track the function's work in more detail. The project control manager then coordinates activities across functions.

Project Procurement

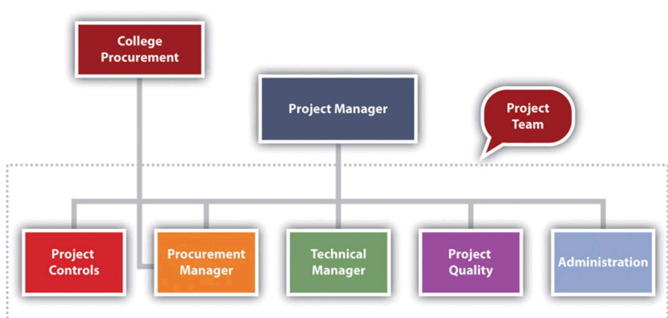
The approach to purchasing the supplies and equipment needed by the project is related to the complexity profile of the project and is, therefore, elaborated on in this chapter; however, the procurement process is discussed in more detail in Chapter 9. A small project with a low complexity level may be able to use the procurement services of the parent organization. In an organization where project **resources** reside in various departments, the departments may provide the supplies and equipment each team member of the project may need.

Southern College Procurement Organization

A college in South Carolina chartered several projects to increase the energy efficiency of the college. The project team included members from various college departments. Each department paid for the time, travel expenses, and supplies needed by the team member from their department. Each team member continued to use the computers and administrative support in their department for project work. The costs for this support were not included in the project budget nor tracked as a project expense. Equipment purchased by the project that was installed to reduce the energy consumption of the college was purchased through the college procurement department and charged to the project.

More complex projects with greater procurement activity may have a procurement person assigned to the project. This same South Carolina college retrofitted a warehouse to create a new training center for the industry. A procurement person was assigned to the project to manage the contract with the construction firm remodelling the space, the purchase and installation of the new training equipment, and the purchase of the supplies needed by the project team. All the procurement activity was charged to the project. The procurement person reported to the project manager for better communication on what the project needed and participated as a member of the project team to understand and provide input into the costs and scheduling decisions. She also reported to the college procurement manager for developing and implementing project procurement processes that met college procurement policies and procedures.

Figure 3.3 The Procurement Manager is Part of the Project Team



On larger, more complex projects, the procurement team has several responsibilities. The team is responsible for procuring the supplies and equipment (such as office supplies and computers) needed for the project team and the supplies and equipment (such as the training equipment) needed to execute the project. On an instructional filming project, the procurement team would rent set fixtures, office supplies, and computers for the project team to outfit a film crew on location. The procurement team would also purchase or acquire costumes, make-up artists, catering services, camera operators, and other materials needed for filming.

Image bty Kulli Kittus

Procurement for Distance Learning Project in South America

On the large distance learning project in South America, during the **initiation phase** of the project, the procurement department arranged for office space and supplies for the design teams in Canada, Chile, and Argentina and offices at the site in Argentina. As the design progressed, the procurement team managed bids for the computer equipment and bids for the preparation of the campus site. The procurement team managed the logistics associated with transporting equipment from Europe, North America, and Asia to the job site in rural Argentina. After the completion of the project, the procurement team managed the deposal of the project property.

On large, complex projects, the procurement team manages at least three types of relationships with companies doing business with the project.

Commodity Procurement

The largest number of purchased items for most projects is commodity items. Commodities are items that can be bought off the shelf with no special modification for the project. These items are typically bid and the lowest prices that can meet the schedule of the project will win the contract. The procurement team assures the company that wins the bid can perform to the contract specifications and then monitors the progress of the company in meeting the requirements of the project. Software for the project and the computers or other technology leased to the project are examples of commodities. The key to success in managing commodity **suppliers** is the process for developing the bids and evaluating and awarding the contracts.

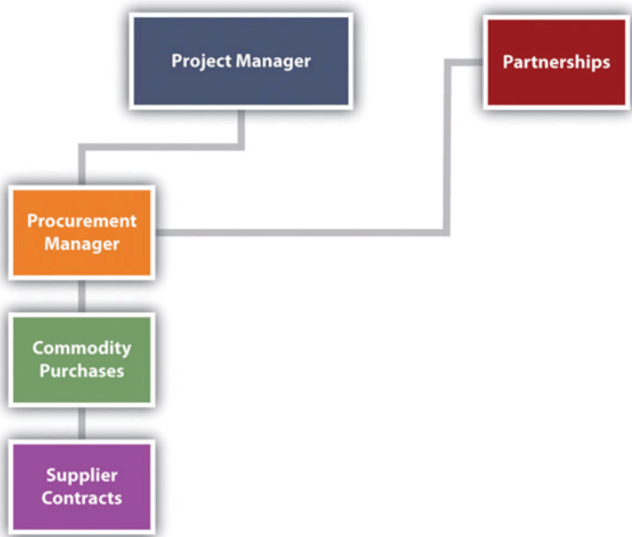
Procurement from **Vendors**

The second type of relationship is the vendor relationship. The terms supplier and vendor are often used interchangeably. In this text, **suppliers** provide commodities, and **vendors** provide custom services or goods. **Suppliers** bid on specialized equipment for the project. **Programmers** will specify the performance requirements of the equipment, and **suppliers** that have equipment that meets the requirements will bid on the project. The programming team will assist in the evaluation of the bids to assure compliance with specifications. The lowest bid may not win the contract. Sometimes the long-term maintenance costs and reliability of the equipment may indicate a high price for the equipment. The key to success is the development of clear performance specifications, good communication with potential bidders to allow bidders to develop innovative concepts for meeting the performance requirements, and a bidding process that focuses on the goals of the project.

Partnerships

The third type of project procurement relationship is the partnership. Sometimes the partnership is legally defined as a partnership, and sometimes the success of each partner is so closely tied together that the relationship operates as a partnership. On the South American project, the project team partnered with an Argentinean instructional design company to access the local education practices and relationships with local software **vendors**. This was a legal partnership with shared profits. The partner also designed and procured some programmed instructional materials on which the success of the project and the company designing the overall project depended. With this type of relationship, a senior manager on the project is assigned to coordinate activities with the partner, and processes are put in place to develop shared goals, align work processes, and manage change.

Figure 3.4 Procurement Manager Relationships



Technical Management

The **technical management** on the project is the management of the technology inherent in the project—not the technology used by the team to manage the project. The technical complexity of a project can vary significantly. The technological challenges required to build a submarine navigation training system are significantly different from those required to build an instructional unit for first-grade math. The technological complexity of the project will influence the organizational approach to the project. The technological complexity for a project reflects two aspects: the newness of the technology and the team's familiarity with the technology. The newness refers to the degree to which the technology has been accepted in the industry. The more accepted the technology is in the industry usually means that more knowledge and experience will be available to the team. Familiarity refers to the experience the project team has with the technology. The less familiarity the team has with the technology, the more energy and **resources** the team will expend on managing the technological aspect of the project. For projects with high levels of project technology, a specialist may be hired to advise the technology manager.

Project Quality

Project quality is often part of the technical manager's responsibility. On large projects or projects with a high degree of technical complexity, the **quality** is sometimes a separate function. The project quality manager focuses on the **quality** of the project work processes and not the **quality** of the client's product. For example, if the project is to design and construct training for insurance agents, the quality manager focuses on the project work processes and meeting the technical specification of the instructional materials created by the project team. The project quality manager is not responsible for the **quality** of the instructional materials that the team produces. If the design team's computers, and other support equipment and materials function to the defined project specifications, the **quality** of the instructional designer team's output is the responsibility of the company's quality department, and it may take several months for the company to refine the work processes to meet the design specifications of the instructional materials.

On an instructional design project, the quality manager may test the **programmers** to assure the **programmers** have the skills and that the code meets project specifications. On a training project, the quality manager may review the training curriculum and the qualification of the instructors to assure the training provides the knowledge and skills specified by the client. On a drug development project, the quality manager may develop processes to assure the water and other raw material meet specifications and every process in the development process is properly documented.

Project Administration

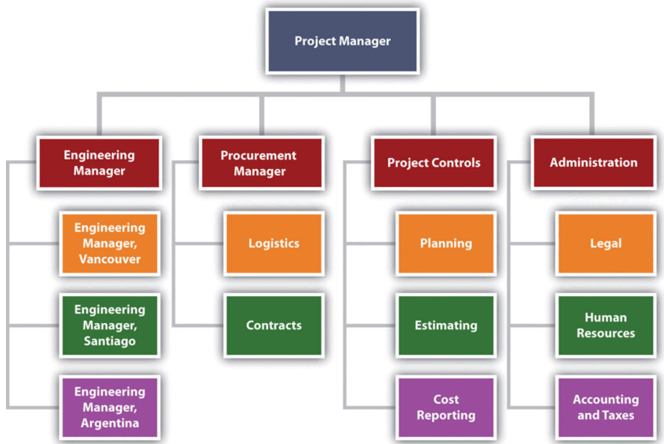
The administrative function provides project-specific support such as the following:

- Accounting services
- Legal services
- Property management
- Human resources (HR) management
- Other support functions found in most organizations

In most organizations, support for these functions is provided by the parent organization. For example, people assigned to the project will get human resources (HR) support from the HR department of the parent organization. Salary, benefits, and HR policies for employees assigned to the project will be supported out of the HR department. The parent organization will provide accounting functions such as determining the cost of cash, taxes, year-end project reports, and property disposal at the end of the project.

The project manager on smaller, less complex projects will have sufficient knowledge about these issues to coordinate with the parent organization's functional leaders. On more complex projects, the project may have an administrative manager responsible for coordinating the administrative functions of the projects. On larger, more complex projects, an administrative function may be established as part of the project team, with many of the functions assigning a resource to the project. In all cases, the administrative function of a project is closely related to the legal and organizational responsibilities of the parent organization and close coordination is important.

Figure 3.5 Organization for Major International Project



KEY TAKEAWAYS

- Key job functions on a project include the sponsor, project manager, controls, procurement, technical, **quality**, and administration.
- The **project sponsor** has the organizational authority to provide guidance and **resources** and can overcome barriers for the project.
- The project manager is the project leader with broad responsibilities for all phases of the project and for meeting project goals and client expectations.
- The project controls manager is responsible for controlling the project processes, including cost estimating and tracking, developing schedules, tracking progress against schedules, managing changes to the schedule or budget, and analyzing trends.
- The procurement manager is responsible for obtaining the services and materials needed to complete the project. This is accomplished by purchasing commodities, managing contractors who provide services and products, and working with partners.
- The technical manager deals with the issues related to the technology of the project.
- The quality manager monitors the project's processes—not the **quality** of the product of the project—and takes steps to assure they are done correctly and meet specifications.
- Project administration manages accounting, legal, property, and human resources.

3.3 Interactive Review

Chapter 3 Interactive Review

An interactive H5P element has been excluded from this version of the text. You can view it online here:
`https://openpress.usask.ca/pm4id/?p=1946#h5p-2`

CHAPTER 4

4 Understanding and Meeting Client Expectations

4.0 Overview

Visit Audio Recordings for the audio version of this section.

This chapter aligns with the beginning of Chapter 3 of the PMBOK where stakeholders are addressed and 11% of the CAPM questions come from this knowledge area. The content connects to the Initiation and Planning category of the PMP questions.

Project management, especially within instructional design, revolves around understanding and meeting client expectations. Even the most efficiently completed project will not count as a success if the client and other important stakeholders are unhappy with the results. Accordingly, every successful project will necessarily have a plan or strategy of some sort in place for making the client happy. Depending on the complexity level of the project, this strategy to meet the client's expectations can range from having a general discussion with the project leadership team to developing a formal plan that is tracked during the life of the project. Since project stakeholders can often exert considerable influence over the success of the project with expertise, political influence, and additional resources, an essential element of such a plan will be on how to motivate the client to contribute to the team's success throughout the life of the project.

Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=66

When I think of client expectations, that's a negotiable item. We want to negotiate with the client, what are reasonable expectations? One of the strange things I found with almost every client is that they don't have the language to tell you what's in their head, necessarily, because of instructional design. Click here to access transcript.

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan

Without the work of the subject matter expert, I won't make any progress on the course. So it's very much a partnership. Click here to access transcript.

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

Miscommunication did happen on this project. We were working with people who were trained in how to operate helicopters, how to fly them and how to operate the electronic equipment in the back of the helicopter. We found that, well first of all, the first communication challenge that we came up against was the communication of the content itself. I wasn't trained in helicopter piloting. I had no idea what a sensor operator was until I shook hands with one. I had no idea how the technical worked. I had no idea how the strategic part of this, how you actually play the chess game of finding a submarine that is under the water. And yet at the surface that's what these people were trained to do. So the first communication problem that we had was the subject matter. The second was the simple day-to-day communications with people who, in some cases, were highly motivated towards our project, and in some cases weren't. Learning to manage people's motivations became a very important challenge for us. There were people who just wouldn't show up for work when they were scheduled to work. Not on my staff but on the Navy's staff. Because they would have a check-ride in a simulator or they'd be doing something else, and we were low priority for them. Probably the biggest miscommunication problem that we had—had to do with an entire section of the subject matter. We mistook that what we were trying, what we were supposed to do was train people how to fly this helicopter and how to operate the sensors in the back of the helicopter. It turns out that, and we did our task analysis, a very thorough task analysis, reams of paper, showing all the things that needed to be trained and these resulted in instructional goals, however there was kind of a meta-performance that these people were engaged in. It was not just flying the helicopter, and not just operating the sensor equipment in the back. It was using the combination of pilot and sensor operator skills as a team to fly across the top of the water, looking for, first of all to detect a submarine and once you had detected it finding a way to keep track of it and to keep tracking. Of course the submarine is trying to escape. So there is this whole strategic, or what they call the tactical section of the training, and we found out about two-thirds of the way through the project that the subject matter expert team had not told us about this part of it, and we had not noticed it, it was kind of a stupid mistake on our part. So I looked at the subject matter, the head subject matter expert and said, we need to do a little bit more task analysis and add some things to the curriculum. Of course, by then, the budget had been set on a certain number of things to be created. And so, when I said to him that means we're probably going to have to create some more instructional pieces. He said, well no, and he started finding excuses not to do that part of the course. Well once again the people on the East coast, because they had clear water, were much more expert it turns out. And when the training hit the East coast training site, the first thing they did was they opened up the box, and they took out the training. And they looked for this part on these tactical exercises. And it wasn't in the course. And so they immediately packed up the box and sent it back and said this course is useless for us. We need the tactical part. And what happened, the long and the short of it was, the U.S. Navy had to make another contract, and design more training. And the subject matter expert turned out to be wrong. He should have said, yeah we're going to develop more training. And so, that's how that worked out.

Heather Bryce – Independent Studies – BYU

Well, we did have some miscommunication. The instructional designer was brand new, and so, wasn't as familiar with our processes as other instructional designers. So when we originally meet, we have all the supervisors meet together for collaborative meetings. Which, these types of meetings can be very expensive when you have a lot of full-time people meeting together. The instructional designer continued to have meetings, but normally what we would do is, we would have meetings with perhaps the student employee who is actually doing the work and not everybody who is involved at the supervisor level. So we had a lot of meetings with people that didn't necessarily need to be there that were probably extra meetings, and that of course made the project become quite expensive in meeting time. So that was a miscommunication on my part in communicating with the instructional designer that all those meetings weren't necessary. So the cost on this course grew quite quickly, but at the same time it was also good because there was a lot of collaboration, more than we would have on a normal course within the department. So, it was not a good thing as far as the course expense, but the course ended up being a really amazing project. The final product was amazing and actually won an award.

Dr. Larry Seawright – Center for Teaching and Learning – BYU

Oh gee, where do I start. In the Learning Suite project, where we are building such a large and complex system that interacts with faculty and students, it accesses University databases that are password protected, that are roll protected. One of the key issues is communication of those requirements to our IT organization. Early on, one of the miscommunications that we had concerned some of the services we needed built, and it just never got done. So here we are progressing right along with the development, and so then we call up this person and say, "Is the service ready?" "What service?" Well, we actually never told them which service it was. So you know, it was a miscommunication on our part, but it was, you know, we didn't tell them exactly what to build, and they have a completely different process. We're not a professional IT organization that normally builds gigantic applications like this. We're the Center for Teaching and Learning, so we're a bunch of PhDs who specialize in design and development of instruction materials and we just kind of happen to fall into building this Learning Suite because we made something called the Syllabus. That is the biggest part of the problem, is we're not IT folks. So I am the associate director and the project director. Kind of, well it's not two hats, its multiple hats that I'm wearing because I do other things. I'm also the Center's evaluator. Etc. Etc. So you see, you know, with a smaller organization we do a lot of things. In big centralized IT organizations where they have not just one, but multiple project managers, that greatly facilitates project management on a scale where you could develop Microsoft Project plans and enterprise wide project plans in lots of detail, spreadsheets, etc. etc. We have a whiteboard where we track things. So the miscommunication happened because of our limited resources. You know, we do what we can, we try to be as professional as we can, but sometimes we fail to communicate in the way that the other party expects. So that was the primary difficulty. So you always want to try to verify that what you ask for got communicated. It got through the request process in a way that they could hear it.

4.1 Including the Client

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe what the client needs to know about the management style during different phases of a project.
2. Identify advantages and disadvantages of including the client on project teams.

To appreciate the skill and effort expended by the project team in achieving the objectives of the project, the client needs to know more about what the team does.

Image by fauxels

Educate the Client from the Beginning

Often the client does not have project management experience and, therefore, does not understand project phases and the requirements of the different phases. A less-experienced client may become frustrated at the changes in the management approach required for the different phases of the project. For example, during the early phases, the project leadership is encouraging creative approaches to accomplishing the project goals. As the project proceeds and the project plan becomes more firm, the project leadership focuses on accomplishing the project goals. The types of meetings, the agenda of the meetings, and the general project atmosphere change as the project moves from the **planning phase** to the production mode of the **execution phase** of the project.

During the last phases on a project, project team members are often tired and beginning to anticipate the transition that will take place at the end of the project. The motivational approach that worked during the early phases of the project is less effective during the final phases, and the project manager applies different approaches to motivating the project team. These changes can be disconcerting on a person's first project. By explaining what to expect and planning with the client a process to minimize the impact of these changes, the project manager prepares the client for these events and reduces the frustration.

Include the Client on Selected Project Teams

The client translates the needs of the organization through chartering the project and defining the project scope to the project manager and the project team. The client also has a supervision role. This supervision is often accomplished through regular project reviews and reports from the project team. Depending on the complexity level of the project, the reviews can vary significantly. On less complex projects, the review might be conducted in a one-hour meeting with a one-page summary document serving as the project progress report. On more complex projects, a full-day meeting might be necessary for the project progress to be fully understood, and the project report may be one hundred pages or more.

In addition to providing the formal overview of the project, most clients would like to actively participate in the success of the project. This is a delicate balance. The participation of the client can have undue influence on project decisions. The advantage of including the client in project activities is to gain the client's personal investment in the project plan, to create a better understanding for the client of the problems the project encounters during the life of the project, and to gain the insights and contributions of the client in problem solving.

Involving the client in teams where the client's special knowledge can add value to the team discussions and activities contributes both to the success of the team and the satisfaction of the client. During the development of a chemical-plant employee training in Tennessee, the project team struggled with a very tight project schedule. A team was established to explore ways to reduce the approval process for the drawings of the instructional design. It was taking two weeks for the design review, and even though this was within the normal time frame for design reviews, the project management team believed there were opportunities to reduce this time and shorten the length of the project.

The client's engineering manager participated in the brainstorming sessions that explored ways to reduce the design review time. Several good ideas were developed and put into place. The client's engineering manager took these ideas back to the client's team and instituted many of the same ideas. There were two positive results: (1) a shortened schedule that saved two weeks by the end of the design, (2) a client that was emotionally engaged in the positive outcomes and contributed to the project success.

KEY TAKEAWAYS

- The project manager's style changes with each phase of the project. The client might not have experience with project phases and needs to be guided through the different phases, the purposes of each phase, and the different management styles those entail.
- Client participation in project teams can have undue influence on decisions, but this is offset by the buy-in of the client and the insights the client can offer when special knowledge is needed or schedules need to be changed.

4.2 Understanding Values and Expectations

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify methods for determining client expectations.
2. Identify methods for clarifying values and determining differences.
3. Describe the importance of dealing fairly with the client.

Two of the sources of dissatisfaction in personal and business interactions are unmet expectations and a misunderstanding or ignorance of the values held by the other party. The project manager needs to avoid having an unsatisfied client due to a clash of values or a failure to meet expectations.

Clarify Expectations

Client expectations are expressed in chartering documents such as the scope of work, the project **purpose statement**, and the list of project deliverables. Other expectations exist that are more difficult to express in written documents.

Managing Expectations

One project client had such a difficult time with the billing processes on her previous project that significant project management time and resources were expended on reconciling billing issues. This client has an expectation in the next project that project accounting and billing processes operate effectively and efficiently. Another client had been constantly surprised by changes and unplanned events happening on the project. This client wanted to participate early in the discussion of problems that arise during the life of the project and contribute to finding solutions and minimizing the negative impact on project performance.

Understanding and capturing these expectations in a written document is an important step in effectively meeting client expectations. Often it is the next question that enables a project manager to discover the less obvious expectations. The next question is the one the project manager asks after the initial response to inquiries about expectations. In our example, the client may express that he or she wants project billings to be accurate and timely. This is an easily understandable expectation, but when the project manager asked the next question—"Can you tell me more about what you mean?"—the client revealed the problems on her previous project, and the project team developed a better understanding of the client's concern. The project team developed measures for tracking project billings that measured both timeliness and accuracy. This process enabled the project team to understand the client's concern, develop work processes that demonstrated a response, and provide data to the client on the timeliness and the accuracy of the billing processes.

For the client that expected to hear about problems early and participate in the problem-solving discussions, the project team shared the project action item register and highlighted issues the team felt may be important to the client. The project manager also discussed potential concerns with the client during their weekly project update.

After the project team captures the client expectations, the team then develops a method for tracking performance against expectations. In our example, the project team defined accuracy and timeliness in measurable terms and tracked the team's performance. The project team developed a survey to track the client's perception of inclusion in the problem-solving process and tracked the client's response. These measures were then presented in the project review meetings with other measures of project performance such as cost and schedule.

As the project team meets and exceeds the client expectations, these expectations tend to change. If the goal is 85% accuracy on all project billings, and the project team begins to perform with an average of 95% accuracy or higher and never falls below 90%, then the client begins to expect 95% accuracy. This is a realistic expectation of the client; it also changes the expectation so that meeting the client's expectation becomes harder. Even if expectations change, it is important to maintain the original goal. This reminds the client at the end of the project that the project team not only met expectations but also raised them during the life of the project.

Clarify Values

Values are desirable principles or qualities.[1] Disagreements based on differences in values are extremely difficult to resolve because compromising means compromising your values. Organizations often have developed a list of corporate values. Sometimes these are real and sometimes they are more important to the corporate brand. The project manager needs to understand the real organizational and personal values of the team members related to the project.

Image by Christina Morillo

Communication Values

A large project in Washington had a client that valued prompt communication. All the members of the client's team had the latest phone technology and took calls during project meetings. The project team saw this behaviour as rude and interfering with the effectiveness of the project. The client was very comfortable in this chaotic environment and valued constant communication because it provided them with a competitive advantage in their marketplace by enabling quick identification and response to opportunities. The same behaviour was preventing the project team from developing a common understanding and agreeing on a project plan because they could not focus on the needs of the project long enough to develop this common understanding. The project manager and the lead client recognized the potential conflict for the project and developed a list of project meetings that would be "cell-less," which meant that the team members would turn cell phones off for that meeting. Other meetings would follow the cultural standards of the client.

Developing a mutual understanding of the personal and organizational values and dealing with differences during the early phases of the project will significantly reduce the potential for insolvable conflicts. This becomes more important on a large, complex project where the likelihood of a diverse project team is high, and the team may have to deal with different laws, customs, and cultural values. Developing an understanding of these differences and developing an appreciation for the value of this diversity for project team members can prevent conflict later in the project.

Deal Fairly with the Client

During the life of the project, the project manager will often have the opportunity to take advantage of the client, either because a clause in the contract is not written accurately or because the project manager has access to more detailed information. For example, a client finds a mistake in the original documents provided to the project team. The project team analyzes the new information to access the potential impact on the project cost and schedule. A skilled project manager can demonstrate a negative impact and increase project profits by requesting a change order. A skilled project manager can also usually find an innovative approach to finding a solution without increasing the cost or schedule. In most cases, the client wants to be treated fairly. Fairness is characterized by impartiality and honesty that is free from self-interest, prejudice, or favoritism.[2] If the client interprets the change order as fair, then the project manager has the opportunity to create a satisfied client. If the client believes the behavior of the project manager is unfair, then it is difficult to create a satisfied client.

KEY TAKEAWAYS

- To identify client expectations, review written documents, but have a dialogue with the client to uncover unwritten expectations by asking questions and listening. Manage increasing expectations by reminding the client of the original objectives.
- Understand the stated corporate values by reviewing written documents and client actions related to those stated values.. Attempt to avoid conflicts of values by identifying the differences before they become problems.
- Do not take advantage of clients' mistakes, but help them meet their objectives in spite of their errors. Live your own values of fairness.

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[1] Merriam-Webster Unabridged Online Dictionary, s.v. "values," http://unabridged.merriam-webster.com/cgi-bin/collegiate (accessed June 18, 2009).

[2] Merriam-Webster Unabridged Online Dictionary, s.v. "fairness," http://unabridged.merriam-webster.com/cgi-bin/collegiate?va=fairness&x=0&y=0 (accessed June 18, 2009).

4.3 Dealing with Problems

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe standards and procedures for dealing with problems.
2. Describe the advantages of dealing with difficult issues as soon as they arise.
3. Describe the importance of establishing methods for revising major decisions.

Projects always experience unexpected problems that produce stress. Dealing with problems with competence is vital to maintaining a good relationship with clients.

Establish Standards and Procedures for Decisions

There are competing interests on projects, and the larger and more complex the project, the greater the number of issues and concerns that need to be addressed.

Competing Interests

It's 7:30 in the morning and the client calls and wants you to have coffee in an hour with the new CEO, who flew in last night, to give him an update on the project. The instructional designers were supposed to be on site at 7:00, but they have still not arrived. A news reporter called and said she has an unnamed source who claims that there are sexual-harassment policy violations in your team. You decide to postpone a team meeting about project scheduling and cancel lunch plans with your daughter. It's going to be a busy day.

On large, complex projects, hundreds of decisions are made every day. Most of the decisions focus on the day-to-day operation of the project. Early in the project, decisions focus on choosing between alternative options for accomplishing project goals and determining how the project will be executed. Later, the focus is typically on solving problems. The project team develops solutions to deal with the barriers that emerge and develops alternative plans to meet project goals. The authority to make decisions is typically established early in the project and identified in a **responsibility matrix**—a table of people and types of problems that might require decisions—as shown in Figure 4.1.

Figure 4.1 The **Responsibility Matrix**

Title	Scope Statement	Work Breakdown Structure	Budget	Quality	Change Management Procedures	Change Approvals
Project Chartering Committee	✓					
Client Representative	✓	✓	✓	✓	✓	✓
Project Manager	✓	✓	✓		✓	✓
Technology Team		✓		✓		
Finance Team			✓		✓	
Schedule Coordination Team		✓		✓	✓	

The **responsibility matrix** identifies roles and client involvement.

Decisions that influence the outcome of the project, such as a delay to the project completion date or an increase in the project costs, typically involve the client. Some clients prefer to make the final decision, with the project manager developing alternative solutions with a cost-benefit analysis of each of the alternatives. Others prefer to be involved in discussions to better understand the barriers, developing alternative solutions and making decisions in a team environment. Understanding the client's decision-making preference and developing procedures and processes that support that preference is important to meeting client expectations.

Develop processes and methods that encourage both the client and team members to identify issues and concerns early and develop processes for dealing with them effectively. Define how and when decisions are made.

Image by Timon Studler

On projects with a low complexity level, the project manager and team leaders can make decisions informally, with short meetings or phone calls. Weekly or monthly staff meetings are appropriate for more important decisions. Even though the decision-making process may be simpler on less complex projects, it is still important to understand the client's expectation for inclusion in the decision-making process and recording decisions and changes in project plans.

On more complex projects, the use of action item registers, weekly staff meetings, responsibility matrices, and other tools foster decision making on a timely basis. For project teams operating in diverse locations, Internet-based tools for recording and tracking action items are beneficial in capturing issues and concerns.

Inform Client of Difficult Issues Early

Project managers typically have a high degree of confidence in their ability to deal with issues and concerns as they arise. Let's say the delivery of some equipment is delayed a week, causing changes in the project schedule, or the beta test of a software program identified far more problems than expected. If the project manager knows the problems, the project has a plan for recovering, the team developed a solution and will be back on track soon, should the project manager inform the client? The answer seems like an easy yes, yet many project managers often believe there is no reason to bother the client with a problem they have under control.

Then suppose a second delay occurs on the equipment delivery or the fixes for the beta test are more costly than expected. Now the problems have elevated to the point the client needs to be informed. The greater the distance between the time of the event and the time the client knows about the events, the greater the client's frustration and mistrust. Including the client in the processes for handling project issues or concerns, as well as recovery planning, enables the client to develop confidence that problems will be addressed successfully. Including the client early in the process for dealing with problems enables the client to contribute with solutions and builds confidence that there is open and clear communication.

New Estimates Increase Cost Projections

On a large, complex project in South America, the project team was re-estimating the project cost and schedule projections after the project design was complete. The team was also conducting a new risk analysis, and the results of the cost and schedule projections, together with the risk analysis, provided the client with better **cash flow** projections. Early in the process, the project team understood that the cost projections would greatly increase and the final project cost would be significantly above the contingency set aside for the project. The client looked for an early indication of the results of the analysis, and the project manager kept reporting it was too early to know. The project team debated how much contingency the project needed and how to inform the client. When the client was told the results of the cost projections, the response was a combination of frustration and anger. The project manager was removed from the project and a new project manager assigned.

In the example above, when first indications suggested that estimates were low and several items in the budget needed extra funds, the project manager should have had conversations with the client. Including one or more members of the client's team in the reevaluation effort would have kept the client informed of the progress regularly and built trust in the new numbers. The project team could have offered suggestions and contributed to possible solutions for addressing the concerns that were developing, as costs were higher than expected. Dealing openly and early with the client is critical to client satisfaction.

Clients are often involved in major decisions on the project. For example, if the project invested another million dollars, the project could be completed a month early. The client will conduct the cost-benefit analysis and decide if the extra expense is worth the gain in time. Once this decision is made, the necessary changes are made in the execution plan and new goals are established through the **change management process**. Later, for reasons outside the control of the project, the project will not experience the time savings from the additional investment of funds. It is important to revisit the decision. A **culture** that encourages project team members to bring up the need for revisiting decisions and a mechanism that makes it easy to surface issues and concerns will increase the likelihood that these issues will come to the attention of the management team.

Establishing a **culture** and a mechanism for revisiting project decisions is important for meeting client expectations.

Emergency Button

An experienced project manager came up with a clever idea to enable his clients to capture the attention of the project team. He gave the client's team a bright red index card and said, "This is your emergency button." The card was a symbol. It empowered the client with the ability to capture the complete attention of the project team. When the client presented the red button, the project manager instantly stopped current activities and focused on the client. The red button meant the project leadership focused on understanding the issue or concern presented by the client and developing project priorities to meet the client's concerns. Although the red button was rarely used, it gave a sense of power to the client and communicated that the client was important. One project manager used the "red button" on four projects, and on two of the projects the card was never used. On one project, the client used the card to get the project ready for a visit from the client's boss, and on the fourth project, the client used the card often. Although the project manager believed the card was overused to get the total attention of the project leadership team, he never regretted providing the client with the card. The "red button" card provided them with a method to distinguish the really important needs of the client.

Revisiting Major Decisions and Issues

The project environment moves fast, and decisions are made and implemented to keep pace. Decisions made in the conceptual phase of the project may not be effective during the design phase. It is not that the decisions made were necessarily wrong, based on the data at the time they were understandable. However, with new information, it is sometimes important to revisit and change decisions made earlier in the project. As obvious as this might sound, many project teams are reluctant to challenge earlier decisions. Without a mechanism in place to revisit decisions, the early decisions may be seen as final. This sense of finality may limit progress and prevent the project from completing on time, as well as potentially having a project that is irrelevant as soon as it is introduced.

Sometimes people ask that decisions be revisited just because they did not like the decision that was made.

Not Revisiting Decisions

On an educational training manual project, the visual design schedule was changed to support the completion of the activities on the **critical path** by a project milestone date. The change increased the number of hours needed to complete the work because of the change in work processes. The project manager accepted the costs of the change to achieve the milestone date, but the manager of the visual design team objected because the change would cause their part of the job to exceed the budgeted amount. The project manager decided not to revisit the decision because no new information was available that would cause the decision to change.

Mechanisms for revisiting decisions are similar to project change orders. With a change order, a request to revisit a decision must be initiated by someone on the team. The formality of methods used by the project to revisit a decision depends on the complexity profile of the project. On less complex projects, an informal discussion in project meetings can develop the awareness that a decision needs to be revisited. On more complex projects, the action item register and the weekly project meetings provide a venue for revisiting decisions.

Vendor Decision Revisited

On a major project creating a new marketing manual for a large university, the priority was completing the manual in time for recruiters to visit athletes and other high school students throughout the country. The client was involved in the process to select major policy wording, and after an expedited bidding process, an instructional design vendor was selected for a critical piece of the manual layout. Later, members of the project team learned that this vendor was overcommitted, and there was a high risk that the vendor would not be able to meet the scheduled dates. Even though it was the client's decision to hire the vendor, the project leadership had established that this kind of issue needed to be readdressed with the client and warned the client of the possible risk and suggested changing plans. The client decided to proceed. Weeks later, the vendor began missing critical dates just as the project team predicted. Since the issue had been revisited, the client took the blame. Changes were made that brought the project back on track and the project finished on time and within budget, making the client even more impressed with the project team.

KEY TAKEAWAYS

- Determine who should be included in decisions for each category using a decision matrix.
- Additional information that is developed during the design and **planning phase** can require that decisions made during the conceptual phase need to be reconsidered.
- Decide at what level of a problem the client should be involved by discussing the threshold with the client. Involve the client early in the process and provide a mechanism to give them a chance to contribute to the solution before the problem gets worse.
- Decide what criteria to use to determine when a decision should be revisited.

4.4 Instructional Design Case Study

Client Expectations: Case Study

Project management relies heavily on both parties, the design team and the client, to have an understanding of the project expectations. Consider someone trying to lose weight. If they hire a personal trainer to help them achieve their goals, then they are more likely to be successful. But what happens if the client, Terry, and the trainer do not practice good project management strategies?

Example 1: Client Ignores the Design Team

The trainer creates a strict diet and exercise plan for Terry. The plan is for safe and healthy weight loss. The trainer thinks a reasonable goal is for Terry to lose 20 kilograms (kg) by the end of the year. The trainer believes that Terry can handle the plan independently, as long as Terry agrees to do weekly, independent weigh-ins and a one on one check-in with the trainer every 4 months.

Terry thinks that 20 kg is an amateur goal. Terry increases the goal to 50 kg without consulting the trainer. Terry also neglects to follow the plan and does not do the independent weekly weigh-ins.

If Terry continues to ignore the trainer, then what results can Terry hope to see at the 4 month check in? How will this impact the plan for Terry for both Terry and the trainer?

Example 2: Design Team Ignores the Client

Terry has a simple goal: to develop healthy living habits. But the trainer thinks that Terry has the potential to become a competitive bodybuilder. The trainer gives Terry a program that involves a strict diet and an intense workout regime. Terry does not have time for such a complex plan. Terry has to fire the trainer and gives up on the goal of developing a healthy lifestyle.

For Terry to have success with a realistic weight loss goal, then the trainer needs to create a realistic plan. Terry needs to stick to the plan and make use of available resources to stay on track. Terry needs to be educated for this health journey and needs to create clear and realistic expectations.

What communication strategies and tools will assist the trainer in meeting Terry's goals? How can Terry and the trainer practise good project management skills to ensure that the plan stays focused and achieves the best results?

CHAPTER 5

5 Working with People on Projects

5.0 Overview

Visit Audio Recordings for the audio version of this section.

This chapter aligns with Chapters 3 and 9 of the PMBOK and 18% of the CAPM questions come from these chapters. The content connects to the Planning and Executing category of the PMP questions.

Few skills are more essential to the project manager than the ability to lead, inspire, and manage people effectively. By effectively managing relationship dynamics and enhancing communication among team members, a project manager can contribute enormously to the success of any given endeavour. Moreover, as project scope and complexity increase, these skills become increasingly important lest the project fall into a tangle of petty factions and unclear expectations.

Some of the key skills include:

1. The ability to work well with individuals. This includes skills such as responsiveness to the needs and motivations of team members and the ability to effectively negotiate and resolve disputes.
2. The ability to create effective team dynamics. The project manager must take the lead in ensuring that trust and accountability are engendered, developing goals, effectively managing meetings, and monitoring team progress.
3. The ability to create a **project culture**. Successful **project cultures** are characterized by a strong shared vision of success and a consistent set of values that guide members of the project team in their independent decision making.

The concepts discussed in this chapter are not meant to be an exhaustive description of the skills required to successfully work with people on a project, but instead are meant only as a starting point. Some students of social dynamics mistakenly think that they can learn people skills solely from what they read in a book. This notion would be tantamount to an aspiring violinist hoping to learn the instrument by reading about music theory without ever physically touching the instrument! The principles that follow are the groundwork as you begin to build your own mental map of what effective people management and leadership looks like.

Note for ID: Effective people management is perhaps more important within instructional design than it is within a more prototypical setting, such as within a software company or building construction business. Instructional design projects are often characterized by small teams, vaguely specified client deliverables, the requirement to work closely with many individuals who do not have a vested interest in the outcome of the project, such as the subject matter experts (SMEs), and oftentimes a limited budget. Although no specific domain of project management has a monopoly on difficulty, the instructional design project manager has his or her own unique set of challenges and needs – especially when it comes to working with people.

Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

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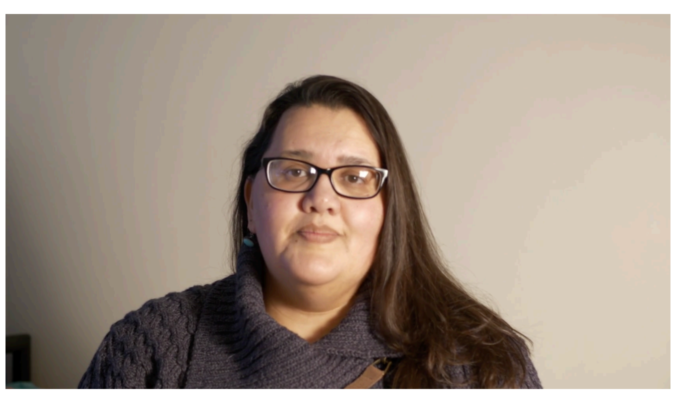
In our own projects, and I think every project I've ever done whether corporate, government, or academic clients, I find that one of the real challenges, the greater challenge, is to work with my team, because I'm working so closely with them than I am even working with a client. Click here to access transcript.

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan



If there's a problem in a project, I will first try and discuss it with the subject matter expert, making sure that they're aware of an issue that we might have to follow up on, deal with, or make plans for. Click here to access transcript.

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

Well on this project where we were—we were training our diverse group. We were training submarine, excuse me, we were training helicopter pilots and we were training sensor operators who sit in the back and are completely different. One group was officers. One group was not officers, they were enlisted people. So, there was a great diversity of people we had to communicate with. I was very fortunate in this project because of some staffing. You know, it was not skill on my part or good choices on my part. We had two people whose personalities really spelled the success of the project. One was an untrained instructional designer. He was a Harvard graduate, he had his Bachelors from Harvard, and yet he wasn't employed in a law firm, you know, he wasn't advancing in his career. He was kind of in-between trying to decide what he wanted to do, but he had this wonderful outgoing personality, people just loved being around him, they wanted to talk to him all the time. And so he was kind of the heartbeat of the project. He was the glue that made all this diverse group of people, he was a motivator, he was exciting to be around. The second person was a Navy, former Navy, was a retiree. He had been in the Navy for so long and we were working with Navy personnel, both officers and enlisted people. He had been a fairly high ranking enlisted person. And he knew how not to take "guff" from enlisted people. He knew how to address officers, and he was on the technical side of things. He was very skilled with people within the military world. Without those two guys this would have been the biggest disaster. This project would have not worked, so personalities were incredibly important.

Heather Bryce – Independent Studies – BYU

Well on Art 45, it's unusual because the instructor is actually an artist. Then we have an art director. Our flash supervisor has an art background, and he also has his masters in Instructional Design. And then we have our videographer who is artistic. So we had a lot of artistic personalities on this project. I think most of our team is used to working together, so I think the synergy was really great there, they had great ideas supporting because they're aware of what each role can do. I think the only, probably one thing that made this course, this project a little more interesting was our art director and our flash supervisor are both artists, and then of course the author is an artist. So they sometimes differed on how things should be presented. So I was really, they did a fantastic job in finding compromise. Because at the end of the day with our courses we have the final say with what is in a course. The author will give us the material, but we have the final say in how to present it. I think we found a nice way. Some things we went with the way that the author wanted to present certain concepts. And other ways, we went with the ways that our team thought it should be presented and I thought it was a good compromise.

Dr. Larry Seawright – Center for Teaching and Learning – BYU

Our Center, we have about 20 full-time employees, and we have a wide variety of personality types. We have some folks who spend a lot of years in industry and kind of got tired of doing that. That would be me. I worked for IBM, Intel, Xerox, companies like that. And then went back, got a Ph.D., and now I'm working at the University. So we have folks that have a lot of industry experience, and we have people who have just come up through the University. Ph.D., you know, maybe a few years working as high school teachers, get a Ph.D. and now they're working with us. And so their experience with real world kinds of applications is kind of limited. Sometimes you get clashes there because you have people who have been used to running in industry large teams, and they have lots of resources and they expect things to be done like this. When I worked at Intel for example, there were lots of meetings where, you know, folks were yelling at each other. Literally yelling at each other in the meeting, and then you walk out the door and you talk about, you know, see you at the tee at four o'clock. Like they're bitter enemies, but they're best of friends. But that's the corporate mentality, the corporate culture. Here, the culture is let's all get along, and so when we had these personalities that have different, very different backgrounds it takes a little massaging. So as project manager it's my job is to smooth some ruffled feathers here, and to keep the kind of egos from getting bruised and keep doing the great work that they're doing without taking offence at what appear to be slights. And that is all communication when it comes down to it. Folks say things and we don't understand it because of different contexts. So frequently you have to have separate meetings. This is what this person meant and this is what this person meant so we can all get along right? A large part of what the role of a project manager is, is to make sure that those kind of communication issues get smoothed over. Not covered up, but smoothed over and clarified so that the project can keep moving forward.

5.1 Working with Individuals

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LEARNING OBJECTIVES

1. Describe **emotional intelligence**.
2. Describe personality types and tools used to describe them.
3. Describe the relationship between leadership style and personality types.
4. Describe people skills that are necessary for negotiation and conflict resolution.
5. Describe how work is delegated.
6. Describe individual goals that are related to personality types.

Working with other people involves dealing with them both logically and emotionally. A successful working relationship between individuals begins with appreciating the importance of emotions and how they relate to personality types, leadership styles, negotiations, and setting goals.

Image by Christina Wocintechchat-com

Emotional Intelligence

Emotions are both a mental and physiological response to environmental and internal stimuli. Leaders need to understand and value their emotions to appropriately respond to the client, project team, and project environment. Daniel Coleman[1] discussed emotional intelligence quotient (EQ) as a factor more important than IQ in predicting leadership success. According to Robert Cooper and Ayman Sawaf, "***Emotional intelligence*** is the ability to sense, understand, and effectively apply the power and acumens of emotions as a source of human energy, information, connection, and influence."[2]

Emotional intelligence includes the following:

- Self-awareness

- Self-regulation
- Empathy
- Relationship management

Image by Infusionsoft

Emotions are important to generating energy around a concept, to building commitment to goals, and to developing high-performing teams. **Emotional intelligence** is an important part of the project manager's ability to build trust among the team members and with the client. It is an important factor in establishing credibility and an open dialogue with project stakeholders. **Emotional intelligence** is critical for project managers, and the more complex the project profile, the more important the project manager's EQ becomes to project success.

Personality Types

Personality types refer to the differences among people in such matters as what motivates them, how they process information, how they handle conflict, etc. Understanding people's personality types is acknowledged as an asset in interacting and communicating with them more effectively. Understanding your personality type as a project manager will assist you in evaluating your tendencies and strengths in different situations. Understanding others' personality types can also help you coordinate the skills of your individual team members and address the various needs of your client.

The ***Myers-Briggs Type Indicator (MBTI)*** is one of the most widely used tools for exploring personal preference, with more than two million people taking the MBTI each year. The MBTI is often referred to as simply the Myers-Briggs. It is a tool that can be used in project management training to develop an awareness of preferences for processing information and relationships with other people.

Based on the theories of psychologist Carl Jung, the Myers-Briggs uses a questionnaire to gather information on the ways individuals prefer to use their perception and judgment. Perception represents the way people become aware of people and their environment. Judgment represents the evaluation of what is perceived. People perceive things differently and reach different conclusions based on the same environmental input. Understanding and accounting for these differences is critical to successful project leadership.

The **Myers-Briggs** identifies sixteen personality types based on four preferences derived from the questionnaire. The preferences are between pairs of opposite characteristics and include the following:

- Extroversion (E)-Introversion (I)
- Sensing (S)-Intuition (N)
- Thinking (T)-Feeling (F)
- Judging (J)-Perceiving (P)

Sixteen Myers-Briggs types can be derived from the four dichotomies. Each of the sixteen types describes a preference: for focusing on the inner or outer world (E-I), for approaching and internalizing information (S-I), for making decisions (T-F), and for planning (J-P). For example, an ISTJ is a Myers-Briggs type who prefers to focus on the inner world and basic information, prefers logic, and likes to decide quickly.

It is important to note that there is no best type and that effective interpretation of the Myers-Briggs requires training. The purpose of the Myers-Briggs is to understand and appreciate the differences among people. This understanding can be helpful in building the project team, in developing common goals, and communicating with project stakeholders. For example, different people process information differently. Extraverts prefer face-to-face meetings as the primary means of communicating, while introverts prefer written communication. Sensing types focus on facts, and intuitive types want the big picture.

On larger, more complex projects, some project managers will use the Myers-Briggs as a team-building tool during project start-up. This is typically a facilitated work session where team members take the Myers-Briggs and share with the team how they process information, what communication approaches they prefer, and what decision-making preferences they have. This allows the team to identify potential areas of conflict, develop communication strategies, and build an appreciation for the diversity of the team.

It should be taken into consideration that the MBTI has encountered significant academic criticism related to its validity and reliability. Research by Pittenger illustrates that there is insufficient data to support the MBTI's claim that there is a total of 16 unique types of personality and further suggests that "there is no convincing evidence to justify that knowledge of type is a reliable or valid predictor of important behavioural conditions."[3] While the MBTI may be beneficial in understanding stereotypical personality traits, it falls short of capturing a person's full individuality.[4]

Another theory of personality typing is the DISC method, which rates people's personalities by testing a person's preferences in word associations in the following four areas:

- Dominance/Drive—relates to control, power, and assertiveness
- Inducement/Influence—relates to social situations and communication
- Submission/Steadiness—relates to patience, persistence, and thoughtfulness
- Compliance/Conscientiousness—relates to structure and organization

Personality Type Badges

One project team in South Carolina used colour-coded badges for the first few weeks of the project to indicate Myers-Briggs type. For this team, this was a way to explore how different team members processed information, made decisions, and took action.

Understanding the differences among people is a critical leadership skill. This includes understanding how people process information, how different experiences will influence the way people perceive the environment, and how people develop filters that allow certain information to be incorporated while other information is excluded. The more complex the project, the more important the understanding of how people process information, make decisions, and deal with conflict. There are multiple personality-type tests that have been developed and explore different aspects of people's personalities. It might be prudent to explore the different tests available and utilize the one(s) that are most beneficial for your team.

Leadership Styles

Leadership style is a function of both the personal characteristics of the leader and the environment in which the leadership must occur, and a topic which several researchers have attempted to understand. Robert Tannenbaum and Warren Schmidt[5] described leaders as either autocratic or democratic. Harold Leavitt[6] described leaders as pathfinders (visionaries), problem solvers (analytical), or implementers (team oriented). James MacGregor Burns[7] conceived leaders as either transactional (focused on actions and decisions) or transformational (focused on the long-term needs of the group and organization).

Fred Fiedler[8] introduced his contingency theory, which is the ability of leaders to adapt their leadership approach to the environment. Most leaders have a dominant leadership style that is most comfortable for them. For example, most engineers spend years training in analytical problem solving and often develop an analytical approach to leadership.

A leadership style reflects personal characteristics and life experiences. Although a project manager's leadership style may be predominantly a pathfinder (using Leavitt's taxonomy), most project managers become problem solvers or implementers when they perceive the need for these leadership approaches. The leadership approach incorporates the dominant leadership style and Fiedler's contingency focus on adapting to the project environment.

No particular leadership approach is specifically appropriate for managing a project. Due to the unique circumstances inherent in each project, the leadership approach and the management skills required to be successful vary depending on the complexity profile of the project. However, the Project Management Institute published research that studied project management leadership traits[9] and concluded that good communication skills and the ability to build harmonious relationships and motivate others are essential. Beyond this broad set of leadership skills, the successful leadership approach will depend on the profile of the project. For example, a transactional project manager with a strong command-and-control leadership approach may be very successful on a small software development project or a construction project, where tasks are clear, roles are well understood, and the project environment is cohesive. This same project manager is less likely to be successful on a larger, more complex project with a diverse project team and complicated work processes.

Matching the appropriate leadership style and approach to the complexity profile of the project is a critical element of project success. Even experienced project managers are less likely to be successful if their leadership approach does not match the complexity profile of the project.

Each project phase may also require a different leadership approach. During the start-up phase of a project, when new team members are first assigned to the project, the project may require a command-and-control leadership approach. Later, as the project moves into the conceptual phase, creativity becomes important, and the project management takes on a more transformational type leadership approach. Most experienced project managers are able to adjust their leadership approach to the needs of the project phase. Occasionally, on very large and complex projects some companies will bring in different project managers for various phases of a project. Changing project managers may bring the right level of experience and the appropriate leadership approach, but is also disruptive to a project. Senior management must balance the benefit of matching the right leadership approach with the cost of disrupting established relationships.

Multinational Textbook Publishing Project

On a project to publish a new textbook at a major publisher, a project manager led a team that included members from partners that were included in a joint venture. The editorial manager was Greek, the business manager was German, and other members of the team were from various locations in the United States and Europe. In addition to the traditional potential for conflict that arises from team members from different cultures, the editorial manager and business manager were responsible for protecting the interest of their company in the joint venture.

The project manager held two alignment or team-building meetings. The first was a two-day meeting held at a local resort and included only the members of the project leadership team. An outside facilitator was hired to facilitate discussion, and the topic of cultural conflict and organizational goal conflict quickly emerged. The team discussed several methods for developing understanding and addressing conflicts that would increase the likelihood of finding mutual agreement.

The second team-building session was a one-day meeting that included the executive sponsors from the various partners in the joint venture. With the project team aligned, the project manager was able to develop support for the publication project's strategy and commitment from the executives of the joint venture. In addition to building processes that would enable the team to address difficult cultural differences, the project manager focused on building trust with each of the team members. The project manager knew that building trust with the team was as critical to the success of the project as the technical project management skills and devoted significant management time to building and maintaining this trust.

Leadership Skills

Einsiedel[10] discussed the qualities of successful project managers. The project manager must be perceived to be credible by the project team and key stakeholders. The project manager can solve problems. A successful project manager has a high degree of tolerance for ambiguity. On projects, the environment changes frequently, and the project manager must apply the appropriate leadership approach for each situation.

A successful project manager must have good communication skills. Barry Posner[11] connected project management skills to solving problems. All project problems were connected to skills needed by the project manager:

- Breakdown in communication represented the lack of communication skills.
- Uncommitted team members represented the lack of team-building skills.
- Role confusion represented the lack of organizational skills.

The research indicates that project managers need a large number of skills. These skills include administrative skills, organizational skills, and technical skills associated with the technology of the project. The types of skills and the depth of the skills needed are closely connected to the complexity profile of the project. Typically on smaller, less complex projects, project managers need a greater degree of technical skills. On larger, more complex projects, project managers need more organizational skills to deal with the complexity. On smaller projects, the project manager is intimately involved in developing the project schedule, cost estimates, and quality standards. On larger projects, **functional managers** are typically responsible for managing these aspects of the project, and the project manager provides the organizational framework for the work to be successful.

Listening

One of the most important communication skills of the project manager is the ability to actively listen. Active listening is placing oneself in the speaker's position as much as possible, understanding the communication from the point of view of the speaker, listening to the body language and other environmental cues, and striving not just to hear, but to understand. Active listening takes focus and practice to become effective. Active listening enables a project manager to go beyond the basic information that is being shared and to develop a more complete understanding of the information.

Client's Body Language Indicates Problems at a Board Meeting

A client just returned from a trip to Australia where he reviewed the progress of the project with his company's board of directors. The project manager listened and took notes on the five concerns expressed by the board of directors to the client.

The project manager observed that the client's body language showed more tension than usual. This was a cue to listen very carefully. The project manager nodded occasionally and clearly demonstrated he was listening through his posture, small agreeable sounds, and body language. The project manager then began to provide feedback on what was said using phrases like "What I hear you say is…" or "It sounds like…." The project manager was clarifying the message that was communicated by the client.

The project manager then asked more probing questions and reflected on what was said. "It sounds as if it was a very tough board meeting." "Is there something going on beyond the events of the project?" From these observations and questions, the project manager discovered that the board of directors meeting did not go well. The company had experienced losses on other projects, and budget cuts meant fewer resources for the project and an expectation that the project would finish earlier than planned. The project manager also discovered that the client's future with the company would depend on the success of the project. The project manager asked, "Do you think we will need to do things differently?" They began to develop a plan to address the board of directors' concerns.

Through active listening, the project manager was able to develop an understanding of the issues that emerged from the board meeting and participate in developing solutions. Active listening and the trusting environment established by the project manager enabled the client to safely share information he had not planned on sharing and to participate in creating a workable plan that resulted in a successful project.

In the example above, the project manager used the following techniques:

1. Listening intently to the words of the client and observing the client's body language
2. Nodding and expressing interest in the client without forming rebuttals
3. Providing feedback and asking for clarity while repeating a summary of the information back to the client
4. Expressing understanding and empathy for the client.

Active listening was important in establishing a common understanding from which an effective project plan could be developed.

Negotiation

When multiple people are involved in an endeavour, differences in opinions and desired outcomes naturally occur. Negotiation is a process for developing a mutually acceptable outcome when the desired outcome for each party conflicts. A project manager will often negotiate with a client, with team members, with vendors, and with other project stakeholders. Negotiation is an important skill in developing support for the project and preventing frustration among all parties involved, which could delay or cause project failure.

Vijay Verma[12] suggests that negotiations involve four principles:

1. Separate people from the problem. Framing the discussions in terms of desired outcomes enables the negotiations to focus on finding new outcomes.
2. Focus on common interests. By avoiding the focus on differences, both parties are more open to finding solutions that are acceptable.
3. Generate options that advance shared interests. Once the common interests are understood, solutions that do not match with either party's interests can be discarded, and solutions that may serve both parties' interests can be more deeply explored.
4. Develop results based on standard criteria. The standard criterion is the success of the project. This implies that the parties develop a common definition of project success.

For the project manager to successfully negotiate issues on the project, he or she should first seek to understand the position of the other party. If negotiating with a client, what is the concern or desired outcome of the client? What are the business drivers and personal drivers that are important to the client? Without this understanding, it is difficult to find a solution that will satisfy the client. The project manager should also seek to understand what outcomes are desirable to the project. Typically, more than one outcome is acceptable. Without knowing what outcomes are acceptable, it is difficult to find a solution that will produce that outcome.

One of the most common issues in formal negotiations is finding a mutually acceptable price for a service or product. Understanding the market value for a product or service will provide a range for developing a negotiation strategy. The price paid on the last project or similar projects provides information on the market value. Seeking expert opinions from sources who would know the market is another source of information. Based on this information, the project manager can then develop an expected range from the lowest price that would be expected within the current market to the highest price.

Additional factors will also affect the negotiated price. The project manager may be willing to pay a higher price to assure an expedited delivery or a lower price if the delivery can be made at the convenience of the supplier or if payment is made before the product is delivered. Developing as many options as possible provides a broader range of choices and increases the possibility of developing a mutually beneficial outcome.

The goal of negotiations is not to achieve the lowest costs, although that is a major consideration, but to achieve the greatest value for the project. If the supplier believes that the negotiation process is fair and the price is fair, the project is more likely to receive higher value from the supplier. The relationship with the supplier can be greatly influenced by the negotiation process and a project manager that attempts to drive the price unreasonably low or below the market value will create an element of distrust in the relationship that may have negative consequences for the project. A positive negotiation experience may create a positive relationship that may be beneficial, especially if the project begins to fall behind schedule and the supplier is in a position to help keep the project on schedule.

Negotiation on a Textbook Adoption Project

After difficult negotiations on an open textbook adoption project in Indiana, the project management team met with the publisher and asked, “Now that the negotiations are complete, how can we help you get more adoptions?” Although this question surprised the publisher, the team had discussed how information would flow, and confusion in expectations and unexpected changes always cost the supplier more money. The team developed mechanisms for assuring good information and providing early information on possible changes and tracked the effect of these efforts during the life of the project.

These efforts and the increased trust enabled the publisher to increase adoptions on the project, and the publisher made special efforts to meet every project expectation. During the life of the project, the publisher shared several ideas about how to reduce total project costs and increase efficiencies. The positive outcome was the product of good partner management by the project team, but the relationship could not have been successful without good faith negotiations.

Conflict Resolution

Conflict on a project is to be expected because of the level of stress, the lack of information during the early phases of the project, personal differences, role conflicts, and limited resources. Although good planning, communication, and team building can reduce the amount of conflict, conflict will still emerge. How the project manager deals with the conflict results in the conflict being destructive or an opportunity to build energy, creativity, and innovation.

David Whetton and Kim Cameron[13] developed a response-to-conflict model that reflected the importance of the issue balanced against the importance of the relationship. The model presented five responses to conflict:

1. Avoiding
2. Forcing
3. Collaborating
4. Compromising
5. Accommodating

Each of these approaches can be effective and useful depending on the situation. Project managers will use each of these conflict resolution approaches depending on the project manager’s personal approach and an assessment of the situation.

Most project managers have a default approach that has emerged over time and is comfortable. For example, some project managers find the use of the project manager’s power the easiest and quickest way to resolve problems. “Do it because I said to” is the mantra for project managers who use forcing as the default approach to resolve conflict. Some project managers find accommodating with the client the most effective approach to dealing with client conflict.

The effectiveness of a conflict resolution approach will often depend on the situation. The forcing approach often succeeds in a situation where a quick resolution is needed, and the investment in the decision by the parties involved is low.

Resolving an Office Space Conflict

Two senior managers both want the office with the window. The project manager intercedes with little discussion and assigns the window office to the manager with the most seniority. The situation was a low-level conflict with no long-range consequences for the project and a solution all parties could accept.

Sometimes office size and location is culturally important, and this situation would take more investment to resolve.

Conflict Over a Change Order

In another example, the client rejected a request for a change order because she thought the change should have been foreseen by the project team and incorporated into the original scope of work. The project controls manager believed the client was using her power to avoid an expensive change order and suggested the project team refuse to do the work without a change order from the client.

This is a more complex situation, with personal commitments to each side of the conflict and consequences for the project. The project manager needs a conflict resolution approach that increases the likelihood of a mutually acceptable solution for the project. One conflict resolution approach involves evaluating the situation, developing a common understanding of the problem, developing alternative solutions, and mutually selecting a solution. Evaluating the situation typically includes gathering data. In our example of a change order conflict, gathering data would include a review of the original scope of work and possibly of people's understandings, which might go beyond the written scope. The second step in developing a resolution to the conflict is to restate, paraphrase, and reframe the problem behind the conflict to develop a common understanding of the problem. In our example, the common understanding may explore the **change management process** and determine that the current **change management process** may not achieve the client's goal of minimizing project changes. This phase is often the most difficult and may take an investment of time and energy to develop a common understanding of the problem.

After the problem has been restated and agreed on, alternative approaches are developed. This is a creative process that often means developing a new approach or changing the project plan. The result is a resolution to the conflict that is mutually agreeable to all team members. If all team members believe every effort was made to find a solution that achieved the project charter and met as many of the team member's goals as possible, there will be a greater commitment to the agreed-on solution.

Project Goals Accomplished

In our example, the project team found a new way to accomplish the project goals without a change to the project scope. On this project, the solution seemed obvious after some creative discussions, but in most conflict situations, even the most obvious solutions can be elusive.

Delegation

Delegating responsibility and work to others is a critical project management skill. The responsibility for executing the project belongs to the project manager. Often other team members on the project will have a functional responsibility on the project and report to a functional manager in the parent organization. For example, the procurement leader for a major project may also report to the organization's vice president for procurement. Although the procurement plan for the project must meet the organization's procurement policies, the procurement leader on the project will take day-to-day direction from the project manager. The amount of direction given to the procurement leader, or others on the project, is the decision of the project manager.

If the project manager delegates too little authority to others to make decisions and take action, the lack of a timely decision or lack of action will cause delays on the project. Delegating too much authority to others who do not have the knowledge, skills, or information will typically cause problems that result in delay or increased cost to the project. Finding the right balance of delegation is a critical project management skill.

When developing the project team, the project manager selects team members with the knowledge, skills, and abilities to accomplish the work required for the project to be successful. Typically, the more knowledge, skills, abilities, and experience a project team member brings to the project, the more that team member will be paid. To keep the project personnel costs lower, the project manager will develop a project team with the level of experience and the knowledge, skills, and abilities to accomplish the work.

On smaller, less complex projects, the project manager can provide daily guidance to project team members and be consulted on all major decisions. On larger, more complex projects, there are too many important decisions made every day for the project manager to be involved at the same level, and project team leaders are delegated decision-making authority. Larger projects, with a more complex profile, will typically pay more because of the need for the knowledge and experience. On larger, more complex projects, the project manager will develop a more experienced and knowledgeable team that will enable the project manager to delegate more responsibility to these team members.

Learning Project in Peru

An instructional design project in Peru was falling behind schedule, and a new manager was assigned over the design team that was the most behind schedule. He was an experienced project manager from the United States with a reputation for meeting aggressive schedules. However, he failed to see that as a culture, Peruvians do a great deal more socializing than teams in the U.S. The project manager's communication with the team was then limited because he did not go out and spend more time with them, and his team did not develop trust or respect for him. Due to these cultural differences, the project fell further behind, and another personnel change had to be made at a significant cost of time, trust and money.

The project manager must have the skills to evaluate the knowledge, skills, and abilities of project team members and evaluate the complexity and difficulty of the project assignment. Often project managers want project team members they have worked with in the past. Because the project manager knows the skill level of the team member, project assignments can be made quickly with less supervision than with a new team member with whom the project manager has little or no experience.

Delegation is the art of creating a project organizational structure with the work organized into units that can be managed. Delegation is the process of understanding the knowledge, skills, and abilities needed to manage that work and then matching the team members with the right skills to do that work. Good project managers are good delegators.

Adjusting Leadership Styles

In the realm of personality traits, remember that they reflect an individual's preferences, not their limitations. It is important to understand that each individual can still function in situations for which they are not best suited. It is also important to realize that you can change your leadership style according to the needs of your team and the particular project's **attributes** and scope.

For example, a project leader who is more Thinking (T) than Feeling (F) (according to the Myers-Briggs model) would need to work harder to be considerate of how a team member who is more Feeling (F) might react if they were singled out in a meeting because they were behind schedule. If a person knows their preferences and which personality types are most successful in each type of project or project phase, they can set goals for improvement in their ability to perform in those areas that are not their natural preference.

Another individual goal is to examine which conflict resolution styles are least comfortable and work to improve those styles so that they can be used when they are more appropriate than your default style.

KEY TAKEAWAYS

- **Emotional intelligence** is the ability to sense, understand, and effectively apply emotions.
- Two common tools for describing personality types are DISC (Dominance, Influence, Steadiness, and Conscientiousness) and the **Myers-Briggs Type Indicator (MBTI)**. The MBTI is the most common. It rates personalities on the position

between extremes of four paired terms: Extroversion (E)-Introversion (I), Sensing (S)-Intuition (I), Thinking (T)-Feeling (F), and Judging (J)-Perceiving (P).

- Leadership styles are usually related to the personality of the leader. The type of leadership style that is most effective depends on the complexity and the phase of the project.
- Negotiation and conflict resolution require skill at listening and an understanding of **emotional intelligence** and personality types.
- Delegation is the art of creating a project organizational structure that can be managed and then matching the team members with the right skills to do that work.
- Individual goals can be set for improving abilities that are not natural personality strengths to deal with projects and project phases.

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5.2 Working with Groups and Teams

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the value of trust and how it relates to contracts and complex projects.
2. Identify four types of trust.
3. Describe how a project manager can build trust.
4. Identify three common meeting types and then describe how they differ.
5. Identity types of teams.
6. Describe the HUMM method of measuring project performance.
7. Describe the importance of developing a project story.

A team is a collaboration of people with different personalities that is led by a person with a favoured leadership style. Managing the interactions of these personalities and styles as a group 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 the project suffers in the form of costs increasing and schedules slipping. Often, when reviewing a project where the 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.

Image by rfstudio

On projects, trust is the filter through which we screen the information that is shared and the filter we use to screen 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 and 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

The 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 clearly 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. There is nothing that 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[1] describes four kinds of trust:

1. *Objective credibility.* A personal characteristic that reflects the truthfulness of an individual that can be checked against observable facts.
2. *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.
3. *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.
4. *The 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 on 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 on the project. Project managers can also assure 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 to establish personal trust among team members and with the client. Allotting time during project start-up meetings to allow team members to develop a personal relationship is important to establishing the team trust. The informal discussion allows for a deeper understanding of the whole person and creates an atmosphere where trust can emerge.

High Cost of Lying in a Charleston Project

On a project in Charleston, South Carolina, the client was asking for more and more backup to 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 validating 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 had made a mistake but had not corrected 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.

MANAGING 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 what the short-term priorities are 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 a 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 focused on only those items of information needed for the short-term project plan. The project manager will restate the common understandings 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 favour thinking more than feeling and judging more than perceiving are more comfortable with this type of meeting.

Management Meetings

Management meetings are longer in duration 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 discussion 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, includes 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 midterm 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.

For example, during the early phases of a project, the team is focused on developing a conceptual understanding of the project. A major milestone on complex projects 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 dates
- Developing a human resources plan that identifies critical positions
- Developing and building agreement with the client on the project scope of work

Each of these goals is measurable and time framed. 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 to develop 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 facilitative leadership approach, encouraging the management team to contribute their ideas, and builds 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, to explore the larger issues of the project, and to 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 favour 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 mission and **culture**.

These three types of meetings do not cover all the 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.

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 addressing project opportunities.

Cross-Functional Teamwork on Video Production Project

A cross-functional project team in Tennessee was assigned to develop a project approach to drafting, shooting, and editing educational videos without storing the videos on the school server. Although the complexity of this goal is primarily related to creating the videos and procuring editing equipment, the planning involved coordination of the script drafting, procurement of equipment and talent, and **project controls**. Team members from each of these functions developed and tracked a plan to meet the project goal. Because they communicated so frequently and clearly, the cross-functional team was successful in designing a process and executing the plan in a way that saved three weeks on the video schedule and several thousand dollars in cost by hosting off-site.

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 that 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 on 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[2] 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 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.

Humm Survey Uncovers Concerns

On a project in South Carolina, 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.

DEVELOPING A PROJECT STORY

Every project develops a story. It is the short explanation that project team members give when asked about the project. This is also called the elevator speech, which is the explanation a person would give if he or she were in the elevator with the CEO and the CEO asked him or her to describe the project. Project stories often express important aspects of the project and can create a positive picture of the project or one that is less appealing.

A project story will develop, and creating a positive project story is a project management skill that helps the project. A positive project story is inviting to people and helps with the recruitment of talent to the project. A positive project story also helps when services are needed from functional departments within the company and in developing management support for the project. The project manager actively sets out to create the project story. Creating a positive story entails identifying the unique aspects of the project and building a positive outcome.

Building a Reputation for Project Completion Speed

A project manager in South Carolina always challenged people with speed. He identified the last project with similar characteristics and challenged the team to beat the time by weeks or months. The story became, "If you want a project done on time, this is the project team you need." The project manager created a spirit of competition and fun. The project manager was a high-energy person, and the idea of finding a way to finish a project early seemed a natural outcome.

Every project manager can find the unique aspect of the project and build a sense of specialness about the project. The project becomes a good place to work, provides the team with a sense of accomplishment, and becomes the story created by the project manager.

KEY TAKEAWAYS

- Trust is important to reduce delays caused by excessive filtering and fact checking. Contracts are specific about the project scope, but personal relationships of mutual trust are necessary on complex projects.
- Four types of trust are objective credibility, attribution of benevolence, non-manipulation, and a high cost of lying.
- To create trust, the project manager needs a reputation for trustworthiness and needs to align official goals with operational goals, establish a high cost of lying, and create an atmosphere of respect and benevolent intent.
- Meeting types are action items, management, and leadership. Action item meetings focus on specific short-term priorities. Management meetings focus on planning, and leadership meetings focus on larger issues.
- The types of teams are functional, cross-functional, and problem solving.
- The Humm Factor measures project performance and uses a questionnaire to identify qualitative information about project performance.
- A short statement of the purpose and character of the project is useful in recruiting and obtaining support for a project.

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[1] Svenn Lindskold, "Trust Development, the GRIT Proposal, and the Effects of Conciliatory Acts on Conflict and Corporation," Psychological Bulletin 85, no. 4 (1978): 772–93.

[2] Shari Caudron, "Industry's Unsung Heroes," Industry Week, December 4, 1995, 12–16.

5.3 Creating a Project Culture

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe how **project culture** is developed and enforced.
2. Describe how differences in **culture** between stakeholders can influence the project.
3. Describe the role of innovation on projects.

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 defined **culture** as a pattern of basic assumptions formed by a group on how to perceive and address problems associated with both internal adaptation and external integration.[1] Schein also described organizational culture as an abstract concept that constrains, stabilizes, and provides structure to the organization. At the same time, **culture** is being constantly enacted, created, and shaped by leadership behaviour.

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.

Operational Rules on a Multisite Project

During an instructional design project that required individuals to collaborate remotely, an official rule had been established that individuals would backup their work in a location other than the shared folders they were using every week. It did not take long, however, for everyone involved to see that one member was actively backing up all work. Believing that was sufficient, the operational rule became simply leaving the backing up to a single individual. They assumed that official rules could be ignored if they were difficult to obey.

When this individual fell ill, however, no one picked up the slack and followed the official rule. When some files were corrupted, the team found that their most recent backups were weeks old, resulting in redoing a lot of work. The difference between the official rules and the operational rules of the project created a **culture** that made communication of the priorities more difficult.

In addition to official and operational rules, the project leadership communicates what is important by the use of symbols, storytelling, rituals, rewards or punishments, and taboos.

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.

Culture of Stakeholders

When project stakeholders do not share a common **culture**, project management must adapt its organizations and work processes to cope with cultural differences. The following are three major aspects of cultural difference that can affect a project:

1. Communications
2. Negotiations
3. Decision making

Communication is perhaps the most visible manifestation of **culture**. Project managers encounter cultural differences in communication in language, context, and candour. Different languages are clearly the highest barrier to communication. When project stakeholders do not share the same language, communication slows down and is often filtered to share only information that is deemed critical. The barrier to communication can influence project execution where quick and accurate exchange of ideas and information is critical.

The interpretation of information reflects the extent that context and candour influence cultural expressions of ideas and understanding of information. In some cultures, an affirmative answer to a question does not always mean yes. The cultural influence can create confusion on a project where project stakeholders share more than one **culture**.

Culture Affects Communication in Mumbai

A project management consultant from the United States was asked to evaluate the effectiveness of a management team executing a project in Mumbai, India. The project team reported that the project was on schedule and within budget. After a project review meeting where each of the team leads reported that the design of the project was on schedule, the consultant began informal discussions with individuals. He began to discover that several critical aspects of the project were behind schedule and lacked a mitigating strategy. The information on the project flowed through a cultural expectation to provide positive information. The project was eventually cancelled by the U.S.-based corporation when the market and political risks increased.

Not all cultural differences are related to international projects. Corporate cultures and even regional differences can create cultural confusion on a project.

Cultural Differences between American Regions

Be aware that cultural differences don't only occur if you have a multinational team. On a major project in South America that included project team leaders from seven different countries, the greatest cultural difference that affected the project communication was between two project leaders from the United States. Two team members—one from New Orleans and one from Brooklyn—had more difficulty communicating than team members from Lebanon and Australia.

Image by August de Richelieu

Innovation on Projects

The requirement of innovation on 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 availability of education to the world at large prompted the open education movement, a highly innovative endeavour, which resulted in the textbook you are now reading. Innovation is also important to develop 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 the quality.

Innovation on a Textbook Project

A project manager brought together a team of professors, graduate students, and undergraduates to develop a mathematics textbook. One of the major goals of the team was to present the information in a compelling way. To encourage innovation the project manager was lenient with the dress code, noise levels, and even space (there were members of the team that liked to wander). This created a comfortable atmosphere where participants felt welcome to take risks and suggest a variety of ideas. This approach was not, however, in line with the expectations of the university in which they were housed. The project manager had to decide if he wanted to maintain the lenient atmosphere or ask the team to abide by the expectations of the university. Feeling that the innovation of the project would suffer by changing the dynamic the group had established, the project manager chose to rent office space off-campus.

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.

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 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 an investment of time and energy, and on a time-sensitive project, the project manager must create the motivation and the opportunity for creative thinking.

KEY TAKEAWAYS

- **Project culture** is developed by communicating priority, status, and the alignment of official and operational rules. It is enforced through use of symbols, storytelling, rituals, rewards or punishments, and taboos.
- Differences in **culture** between stakeholders can affect communications, negotiations, and decision making.
- Innovation can be the main focus of the project, or it can be used to achieve improvement in goals that are usually mutually exclusive, such as lowering costs and shortening the schedule.

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[1] Edgar Schein, "Organizational Culture," American Psychologist 45 (1990): 109–19.

CHAPTER 6

6 Communication Technologies

6.0 Overview

Visit Audio Recordings for the audio version of this section.

This chapter aligns with Chapters 4 and 10 of the PMBOK and 18% of the CAPM questions come from this knowledge area. The content connects to the Planning, Executing and Monitoring & Controlling category of the PMP questions.

Almost by definition, projects require teamwork, and team members must communicate with each other for a variety of reasons and by a number of possible methods. For instance, team members frequently need to update each other on their progress and may employ communication methods such as email, project management software, or social media. Available technology can greatly facilitate such tasks and assure timely and accurate communication between team members.

Such technologies include:

- Communication technologies
  - Email
  - Short Message Services (SMS), commonly referred to as texting
  - Video conferencing and chat services, like Skype
  - Blogs and wikis, like WordPress and Mediawiki
  - Microblogging services like TwitterDocument and calendar sharing services like Google Docs
  - Postal and shipping services
- Desktop software tools
  - Microsoft Office or Open Office Suite
  - Visual design and mockup software like Balsamiq
  - Project management software like Microsoft Project or OpenProject

Choosing which communication resource(s) to use on any given project is a critical decision and should be driven by the needs of the project. Generally speaking, simple projects will require fewer communication resources, while larger, multifaceted projects may require more specialized or complex tools and software.

Software tools are constantly changing. Wikipedia maintains a relatively up-to-date listing of various project management programs and their features.

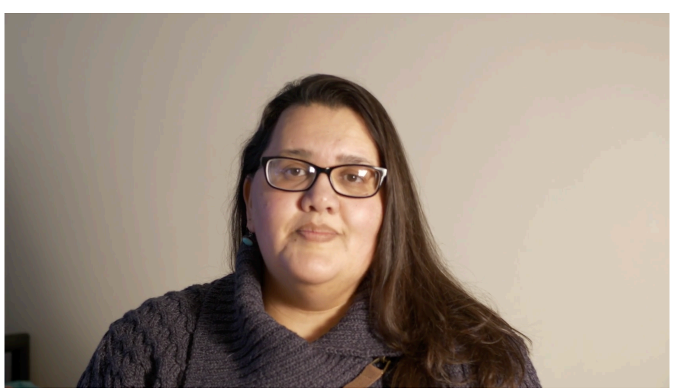
Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=91

With communication channels as they've changed over time, we have so many channels available to us, right. We have so many ways we can communicate with each other. And really, there's no excuse not to, and to have rich communication with each other. Click here to access transcript.

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan



Usually, I would email subject matter experts, quite often just trying to keep up with them, check in with them regularly, make sure that we're on track for meetings and things like that. Click here to access transcript.

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

Well, we were training fairly technical subject matter, it was how to fly a helicopter and how to operate the sensitive electronic equipment in the back, sensors. So that the technologies that we were working with, that we were training people to use were very sophisticated technologies. Unfortunately, we had almost zero technologies. As a designer this was the 1975–76 time frame. The word "processor" was just being invented. We didn't have word processors. Everything was typed by hand, by secretaries. We had an overworked secretary who was constantly typing things. And a lot of hand written documents had to pass. Our design document was typed, and if you made a mistake on a page you would have to re-type the whole page if it was a major mistake, or an addition. So sometimes the documents ended up looking kind of funny. You'd have a document with just a small paragraph at the top. What I'm trying to depict here is we didn't even have the word processor. We didn't even have the desktop publishing that we have today. We had video technology, but we didn't have some of the video editing technologies that we have. So it was almost a razor blade kind of an operation where stuff would end up literally on the cutting room floor, tape would end up that way. Although we did, one of the things, the Navy did give us use of their editing base. So once we had identified the takes that we wanted to edit into our video materials, they—we could do a re-roll kind of thing. But it was, compared to the tools that we have today, if we had had the tools today, then, that we have today the project would have been made much easier. And frankly, my staff would have been cut by half if I had had word processing and design.

6.1 Types of Communication

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify characteristics and examples of **synchronous communication**.
2. Identify characteristics and examples of **asynchronous communication**.
3. Identify questions to answer when considering new communications technologies.

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**.[1] 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

Image by Paul Hanaoka

If all the parties to the communication are taking part in the exchange at the same time, the communication is ***synchronous***. A telephone or Skype conference call is an example of **synchronous communication**. The following are examples of **synchronous communication**:

- *Live meeting*. Gathering of team members at the same location.
- *Conference call*. A telephone call between two or more individuals where 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 normal work hours while team members in North America get some sleep.

Time Zones

It is important to remember time zones and calculate the difference between your time zone and your associates' correctly; to not miss important meetings or deadlines. Figure 6.1 shows how time zones are organized around the world. If you are not sure about specific times, there are many online tools to help calculate time zone differences. Another possible solution is to agree on a time zone for all team members and associates to follow (for example: this project will always refer to dates and times using Greenwich Mean Time). To prevent even further confusion, it may be a good idea to use a twenty-four-hour clock to distinguish between a.m. and p.m. Regardless of the solution that your team decides on, it is important to keep it consistent.

Figure 6.1 World Time Zones

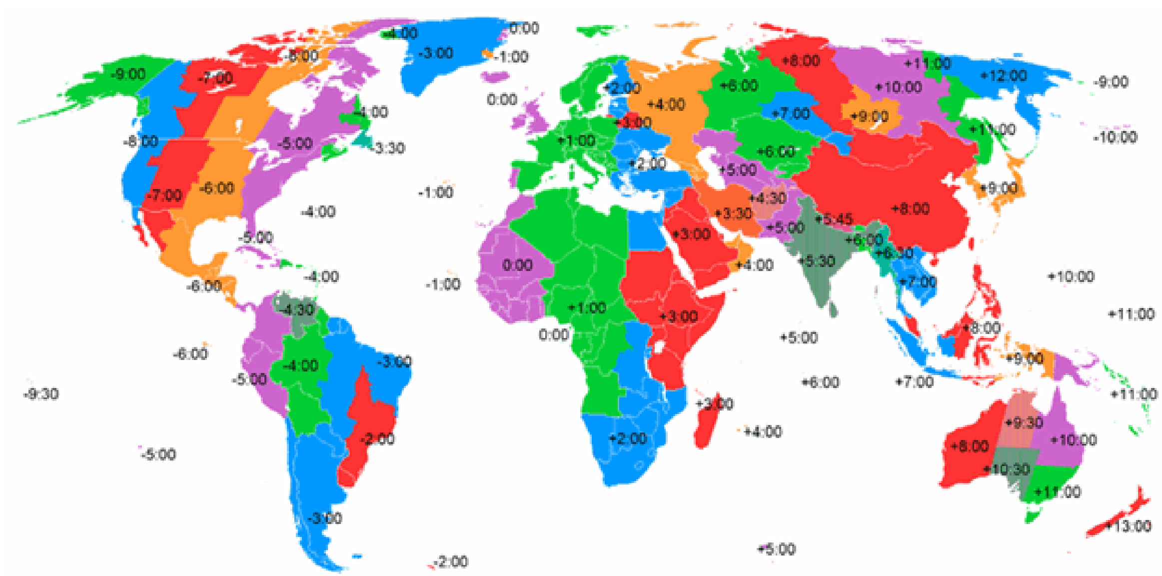


Image by TimeZonesBoy

Conference Call between New York and Paris

A project manager for an online course development project in New York is five time zones west of the reference zone, so the time is given as UTC–5 (or GMT–5). If it is noon in the reference zone, it is 7 a.m. (five hours earlier) in New York. The manager would like to contact a project team member in Paris, France. Paris is one time zone east of the reference zone (UTC+1 or GMT+1). If it is noon (12:00) in the reference zone, it is 1 p.m. (13:00) in Paris.This means that there is a six-hour difference between New York and Paris. If the project manager waits until after lunch to place the call (1 p.m. in New York), it will be too late in the day in Paris (7 p.m.) to reach someone.

Asynchronous Communication

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 are present at the same time. This type of communication is asynchronous. There are several choices of **asynchronous communication**.

Mail and Package Delivery

Many companies prefer that final contracts are personally signed by an authorized representative of each party to the agreement. If several signatures are required, this can take weeks to get all the signatures if the contracts are transferred by a postal service. If this process is holding up the start of the project, you can use an overnight delivery service to minimize the time spent transferring the documents.

Fax

Fax transmissions are still in use and enjoy a high level of trust for accurately transmitting documents. Countries around the world are beginning to allow for the use of e-signatures and digitally signed electronic documents. Laws on the use of e-signatures and electronic documents will vary depending on the country and jurisdiction[2]. New methods of transmitting documents electronically include Adobe Sign and DocuSign, both of which will allow for the application of e-signatures to digital documents.

E-Mail

Electronic mail (e-mail) is widely used to coordinate projects and to communicate between team members. It has several valuable characteristics for project management:

- Information can be sent to a list of team members.
- Messages can be saved to document the process in case of a misunderstanding or miscommunication.
- Files can be attached and distributed.

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, and reflecting on previous decisions to develop this decision-making skill is important to growth as a project manager.

Really Simple Syndication (RSS)

Some projects are directly affected by external factors such as political elections, economic trends, corporate mergers, technological or scientific breakthroughs, or weather. To keep informed about these factors, you can subscribe to online news sources. A technology that facilitates this process is Really Simple Syndication (RSS). Web pages with RSS news feeds have labelled links.

If the user clicks on the RSS feed, news from the website is automatically sent to the user's news reader, such as Google Reader. The news reader can be set to filter the news for key words to limit the stories to those that are relevant to the project.

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 help desk and equipment service for new communication technology?
- What is the cost of training and implementation in terms of time as well as money?

KEY TAKEAWAYS

- **Synchronous communications** take place when all the parties are present at the same time. Examples are telephone calls and video conferencing.
- **Asynchronous communications** take place when the parties are not present at the same time. Examples are email and blogs.
- Determine if a new technology can save time, reduce cost, or prevent mistakes and if the increased complexity can be handled by the team and support staff for an affordable cost in time and money.

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[1] Business Dictionary, s.v. "Virtual Team,"http://www.businessdictionary.com/definition/virtual-team.html (accessed January 27, 2010).

[2] Government of Canada, "Government of Canada Guidance on Using Electronic Signatures," July 15 2019, https://www.canada.ca/en/government/system/digital-government/online-security-privacy/government-canada-guidance-using-electronic-signatures.html, (accessed February 22, 2021).

6.2 Selecting Software

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the factors to consider when assessing software requirements for a project.
2. Define a cloud service and web-based software.
3. Describe the functions of a cloud service.
4. Describe the types of software tools available as **cloud services**.

Assessing Software Requirements

Software needs can vary widely from project to project, since communication becomes increasingly complex as the size of the project increases. Smaller projects involving a smaller team typically have fewer moving parts, and are simpler to manage, while larger projects usually have greater complexity.

Where the team is located geographically, how the team chooses to work together and the team's preferred communication style can also influence the software tools and requirements. Software that is available for multiple platforms and languages can simplify project management and communication significantly.

The **duration** of the project can also be a factor. It is important to consider the communications needs for the entire lifespan of the project, as well as the requirements for storage and archiving the iterative project planning content and materials once the project is complete. Project managers should consider what reporting is needed on an ongoing basis, and how complicated it can be to obtain the information needed for reporting to the client and/or senior management.

How will costs be managed or controlled? Depending on the project, the requirements for budgeting, approvals of expenditures, and tracking or reporting of expenses. As a project manager, you need to consider both your organization's policies and procedures and those of the client. Privacy and access to confidential information, and data security and storage should all be considered. Although a smaller organization might not have policies defined and established as extensively as a larger one, that doesn't mean these issues are any less important. A capable project manager should ensure that requirements are defined and client expectations are set.

The final outcome of the project also influences the software needs, and ultimately the tools selected. Factors such as ongoing management reporting, review of benchmarks and quality, and overall project outcomes should be considered.

Cloud Services

Cloud services is a blanket term that describes a range of web-based software that uses the internet as its communication framework. **Cloud services** are a crucial element of a communication plan for enabling convenient access to numerous web-based software to create documents, spreadsheets, diagrams, and reports that users can simultaneously collaborate on. **Cloud services** and web-based software have several advantages and benefits such as providing a working platform that is free of software and hardware maintenance hassles, saves money, is reliable and convenient, and provides user-friendly online content and information management[1].

Many projects can be managed using the features available in web-based software that is available using an internet connection and accessing the cloud service from a mobile device, tablet, or computer.

Sharing Team Documents

More complex projects involve more people who are often separated geographically and who contribute to the same documents. To manage those tasks and relationships, using cloud-based data storage locations and web-based communication tools is justified. If more than one person on a team will be contributing to a document, the document must be accessible to them. To manage documents that are created by a team, it is necessary to control the edits so that work is not lost or confused.

Version Control and File Storage

Previously, files such as word processing documents and spreadsheets would be stored on an individual's computer or local network and copies sent to participants. These people would then make changes and return the revised version to the person who is responsible for the final version of the document. Today, **cloud services** provide users access to the original copy of a document in a single location. In addition, cloud services provide access to multiple older versions of a file as a contingency against overwriting, accidental deleting, etc.

Feedback and Comments

Feedback in the form of adding comments and markup is one of the features that is particularly useful for keeping track of the changes made to a web-based document by several users. If a team member wishes to explain a change, it is very important that they do not insert their explanation as text into the document. Such explanations might not be deleted and would end up in the final version of the document with potentially damaging results. Instead, team members can use a form of electronic sticky note to make comments. The document owner must go through the document and accept or reject each change and delete all the comments before the document is released as a finished product.

Image by Elle Cartier

Specialized Project Management Tools

A wide range of cloud-based project management tools are available today. These tools have a range of functionality to address task sharing and allocation, deadline management, critical path, file sharing, reporting, and so on. These tools function within a web browser or app and are typically available on a fee per user or per project basis. Like other cloud-based software and services, these allow for real-time project management and collaboration. Users typically have flexibility to view information in a variety of formats, or to sort and filter tasks and activities in a way that is most useful for them.

As will be discussed in further detail in Chapter 8.5, there are many web-based services and mobile apps to help with project management and scheduling. Some of these options include Trello, Miro, and Slack. These services help to organize and plan your project in a digital workspace.

Additional Software Tools

Word Processing

Even the most basic project will generate numerous documents using web-based word processing software. A communications plan can specify standards for these documents that make it easier to create, edit, combine, store, and retrieve the documents. Document standards include the following:

- Specifying the file format
- Using consistent styles
- Using templates for commonly used forms.

Word processing web-based software programs display a document on a computer's screen and allow the user to enter and edit text. When the file is saved to a cloud-based storage device, the text and all the various formatting such as font and font size are converted to a code for efficient storage and for access across multiple devices and platforms. The code varies from one word processing web-based software to another.

Templates and Forms

If a particular type of document will be used repeatedly, it might be worth the time to create an example document—a template—that is formatted using the appropriate styles with blanks or placeholder text where the user can insert the information that describes a particular situation. The template may be customized and used repeatedly for all the documents of that type, or the organization can design its own. Similarly, a variety of tools exist to create web-based forms and surveys that can be used to collect data about various aspects of a project.

Using templates and forms can save time when creating documents and also help ensure that no pertinent details are overlooked when gathering information. **Cloud services** make building forms and sharing and updating templates easier than ever before.

Spreadsheets

Spreadsheets are a display of data in row and column format, in which financial or numerical data can be manipulated. The intersection of the rows and columns are cells into which numbers, text, dates, formulas, and other information can be entered. Formulas can utilize data entered into the spreadsheet for convenient data manipulation. If the value in a cell to which the formula refers is changed, all the formulas that use that cell's value are immediately recalculated. A useful tool that is built into most spreadsheet software is the ability to insert charts and graphs. The software will automatically generate a chart or graph based on the entire spreadsheet or a selection of information. Spreadsheets are widely used to manage data for many aspects of projects.

KEY TAKEAWAYS

- A variety of factors should be considered when selecting software for the project management team
- **Cloud services** provide a range of online software products that allow team members to share, collaborate, and control

aspects of the project.

- Specialized software functionality can address many aspects of communication for the project team. Files can be stored at a location that is accessible by all the team members. Features like track changes and compare documents can help manage edits.

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[1] Prantosh Kumar Paul and Mrinal K. Ghose, "Cloud Computing: Possibilities, Challenges and Opportunities with Special Reference to its Emerging Need in the Academic and Working Area of Information Science," Procedia Engineering 38 (2012): 2222-2227.

6.3 Instructional Design Case Study

Communications Technologies: Case Study

Choosing appropriate communication technologies is key to any successful project of any size. Having the correct communication technology maintains consistency and ensures that everyone involved in the project has adequate information to allow each member to work efficiently towards a common goal.

Warren and his team of a dozen employees are in the midst of designing a website for a celebrity teacher in British Columbia. Warren is responsible for managing the success of this website and has organized his team of designers into three groups. Each team member has their own computer to work on, and they meet in a conference room every Wednesday to discuss progress and upcoming tasks.

Every team member emails an attachment of a document that contains progress of their work to a team supervisor every Friday. Warren receives these attachments in an email from each team supervisor and handles the final edits. Warren starts noticing some inconsistencies in the work being created were causing him increasing difficulties. Some content was being duplicated and wasting the team's time, while other designers were defining and using key terms in the text in an inconsistent manner.

Warren is pleased with the progress each design team has made so far, but feels the project's communication technologies and strategy could be improved for the entire design team. Warren realises he will need to replace the current communication technologies that his team are using with ones that maintain consistency with the work being produced and shared amongst all team members involved in the project.

Try to imagine what communication technologies will improve the project's communication and file sharing strategy? How might they be implemented for the entire design team?

CHAPTER 7

7 Starting a Project

7.0 Overview

Visit Audio Recordings for the audio version of this section.
This chapter aligns with Chapters 3-5 of the PMBOK and 33% of the CAPM questions come from these chapters. The content connects to the Initiating, Planning and Monitoring & Controlling category of the PMP questions.

This chapter provides an overview of the selection and initiation of a project. Prior to the initiation of a project, the ***chartering organization***—the organization that determines the need for the project—develops a justification for the project. Often, several initiatives compete for the resources of the organization, and potential projects are evaluated to see which ones are best aligned with the mission and goals of the organization. This evaluation process can be very simple where the benefits to the organization are obvious and the economics of the project are very favourable. On larger, more complex initiatives, the process of gathering and evaluating the data to justify the project can take a year or more. The information gathered during this evaluation process provides the basis for the project charter, the initial scope of work, and other information required to initiate the project.

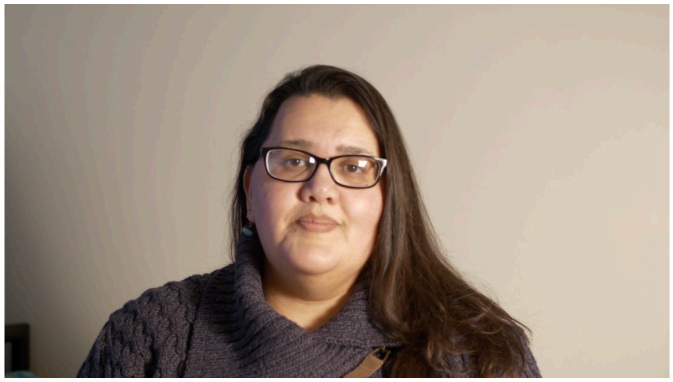
Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=108

Okay, as a project manager, and in the context we're talking about right now, in my context, working with students anyway, the very beginning of a project means I have to go find a project, I have to find one that'll work. And, ironically, this is something that I would love to have students in, but it's not available to them. They haven't even registered for the class sometimes. So here's a little thing, I have often gone to our graduate students and said, how many of you are planning on taking this class with me next term? Click here to access transcript

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan



Probably the most difficult part of an instructional design project is the beginning of it, because you're trying to describe something to a person who is usually unsure about what they're doing, and why they are meeting with an instructional designer. Click here to access transcript.

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

The starting of a project is always an exciting time. There is so much happening and it has to happen so fast, you almost can't catch your breath. This project was on a technical subject matter, how to fly helicopters. I've never flown in a helicopter before, much less piloted one. Sensor operators operating sensitive electronic equipment. So one of the big challenges was getting up to speed on the technology. One of the things that they hadn't taught me in school that I wished they had taught me was about different types of content and how to do an analysis of the subject matter. Because there were different kinds of subject matter in this training. And we were getting up to speed as quickly as we could, but we were treating the subject matter as if it was procedures and rules and facts that had to be memorized. When in fact it was a very complex skill that had to be learned. And we didn't analyze it appropriately. So one of the challenges was how to learn the content fast. And how to see in the content structures that even the subject matter experts didn't see. There were other projects that I worked on where after I had learned to see into content the people had, it's a skill that you learn as a designer by the way, how to see the constructs that exist in their subject matter. There were times when I could actually anticipate and ask questions where the subject matter expert would say "Oh yeah that is a part of our, that is something that you have to learn in order to do this." As designers, one of a designer's biggest challenges at the beginning of a project is getting their minds around the subject matter and seeing invisible structures inside. When training is bad, and as a designer, you get called in to replace somebody else's bad job, or inadequate job. When training is bad very often it is because the subject matter was misconceived. So that was one big challenge. The other was just a matter of getting budgets completed, and getting staff organized, and getting them assigned to tasks, figuring out who is going to do what. Making sure that–one interesting process that we–that I had to undertake was a challenge. And that was, we created probably four or five hundred different pieces, instructional pieces, actually elements, media elements from videotapes down to individual handout lessons that had to be managed and configure managed–configuration managed. And we had to have a way as they were going through the development process.

Each piece that was created had to go through seven or eight stages including, the reviews and the paste-up artists, and the Navy reviews, and the subject matter, excuse me the designer reviews. Artwork had to be created, text had to be written. And so each piece had to go through a chain of events. Managing one piece of instruction through that chain of events, and because there were things that were this kind of event, there were this kind of workbook, or maybe there was this kind of a slide sound presentation, or a videotape, or there were all kinds of different events going through this process. We found that managing that was going to be a nightmare, and so one of things that really saved us on this particular project was we devised a little system of, you normally had some kind of a check off that would go around with each package of material at each stage of development. Well, we devised a little system where each person, as it would get sent to the artist, and it says create the art for this segment. When they had finished it they would check it off and they would put the date and the time and then they would clip that and put it into a box. Each day at the end of work we were able to tell where every segment was because it was going to be on somebody's desk. We were able to tell how much time they had worked on it and how fast things were moving through this pipeline. And which artists had free time, which artists had surplus–who didn't have surplus but were being overworked and were falling behind. It was a stroke of luck actually that we discovered early on that we had to have this kind of a tracking system for all these little tiny pieces and parts that had to go through this system. That was a really a stroke.

Heather Bryce – Independent Studies – BYU

With Art 45, I think our greatest challenge was at the beginning there were so many ideas. Because we had so many artists working on the project, people with art backgrounds. So I think that the challenge was trying to figure out how do we best present this in a long distance atmosphere. Traditionally, with an art class, you're in the classroom, the teacher is looking at what you're doing, you're seeing examples. And so as much as possible we wanted to see how we could give that experience. So it was a combination of having everyone at the table talking about, well this would be a good example of when video would be appropriate for the actual instructor to draw or, you know, show what she is doing. We showed technology, you know, have them show the program and a little video snippet and then some Flash activities where the student can have some kind of virtual experience. So I think that was probably the beginning, the start-up. All these amazing ideas, how to bring them in together and be concrete in deciding okay what is the best way to proceed?

Dr. Larry Seawright – Center for Teaching and Learning – BYU

Well, the project start-up for the BYU Learning Suite was a little bit kind of an interesting start-up. The way evolved is out of an existing product. We built something called the Syllabus Builder, which was an attempt to offer a systematic way for departments and faculty to build a uniform syllabus. We did a database at the backend of it at the request of a college who needed to output all of their syllabi for creditors. The University as they were going through and looking at the learning management system with the University currently purchases and renews on an annual basis. As they were looking at alternatives to that, one of the administrators took a look at the Syllabus Builder and said “Hey we could extend that and make it into a learning management system.” And so the start-up of the project really came from the University down to us. And they gave us a huge list of requirements. So the start-up was really difficult because we had to pair through all of those requirements and match those against our limited capabilities and see, you know, what could we do in the, with the resources that we had. The people, the money, which is essentially how much can we pay for students. And the time that we have to make all of this stuff. And so, you know, start-up was interesting. And then of course, because of who we are, we have lots of instructional designers, we have consultants who have Ph.D.’s in Instructional Design. So they went out and started talking to faculty and students, so our list of requirements, it got to be really big. And we had, you know, our biggest challenge at start-up was to figure out what we could do in the time frame that the University was going to give us.

7.1 Project Selection

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the difference between an organization's mission, goals, and objectives.
2. Describe how the missions are different depending on the type of organization.
3. Define economic terms used for choosing projects.
4. Describe the influences of funding, timing, and unofficial considerations on project selection.
5. Define a project champion and his or her role.

Projects are chosen for a variety of reasons and not all of them are apparent. The project manager must understand why a project was selected over other choices so that he or she can align the team toward justifying the choice that has been made by senior management.

Mission of the Organization

The mission of an organization is a statement of why it exists. For example, a police department might have its mission stated on the door of each patrol car—to protect and serve. A well-written mission statement is short and has the following sections:

- Purpose of the organization
- Primary stakeholders
- Responsibility of the organization toward the stakeholders
- Products or services offered

Image by UK Department for Business, Innovation and Skills

BYU IP&T Department Mission Statement

The objective of the Department of Instructional Psychology and Technology is to enhance learning by improving instruction and teaching. In partnership with others, the department will (1) search for knowledge that improves instruction, (2) apply knowledge and technology to solve instructional problems, and (3) empower students with knowledge and skills in instructional development, research, evaluation, and measurement.[1]

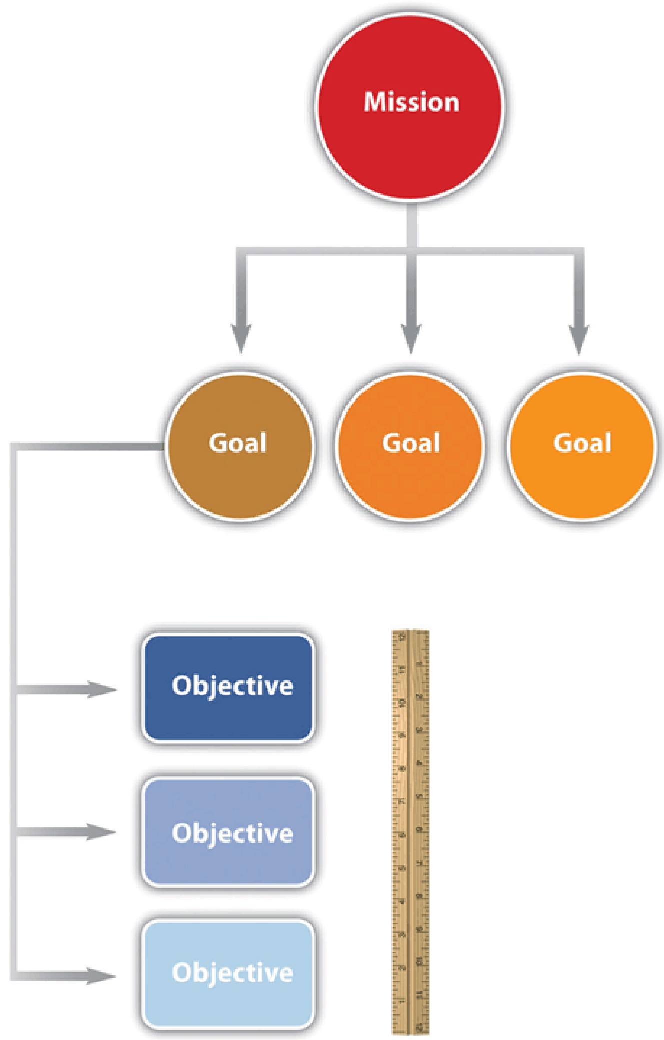
Organizations can be categorized as profit, not for profit, and government. A business that is created to make a profit for its owners and stockholders must consider the cost of each project and how much profit it is likely to generate. The mission statement of a not-for-profit organization, like a charity, would emphasize the service it provides. A not-for-profit organization must control its costs so that it does not exceed its funding, and it is always seeking funding and is in competition with other not-for-profit organizations for funding from the same sources. A government agency, like a police department, is similar to a not-for-profit organization but its sources of funding are usually taxes and fees. Its mission would include its responsibilities to the citizens it represents. Government organizations compete for funding from higher levels of government. Projects are more likely to be funded if the proposal for the project is closely aligned with the mission of the organization. The project manager must be aware of that mission while building a team and aligning it behind the purpose of the project.

Goals and Objectives

Senior administrators of the organization decide on how to achieve the mission of the organization by choosing goals. For example, the director of a not-for-profit preschool that provides low-cost education for children of poor, single parents might set a goal of improving its reputation for quality. A ***goal*** is an end toward which effort is directed. The director meets with her staff and they consider several ways of achieving that goal. They decide to seek certification by a nationally known group that evaluates the quality of preschool programs. Obtaining this certification is an objective.

In this text, we distinguish between the terms goals and objectives. An ***objective*** must have a measurable outcome. In this example, it is easy to measure whether or not the organization receives the certification, which is the distinguishing characteristic of an objective. The use of these terms is not standardized across the industry or in business, but we will be consistent within this text. To determine whether a statement is a goal or an objective, simply ask if there is a measurable outcome. Seeking the certification is an objective that can be met by treating it as a project that has a measurable outcome and a limited time frame.

Figure 7.1 Relationships between Mission, Goals, and Objectives



Economic Selection Criteria

If an organization's mission is to make money, it will try to maximize the profits of the company by increasing the money coming in or decreasing the money going out. The movement of the project's money is called ***cash flow***. Money coming in is positive **cash flow**, and money going out is negative. The company can maximize profits by improving its operational efficiency or by executing projects. The company must raise money to fund projects. Companies can raise money in three ways:

1. Borrow it (government organizations, such as cities and schools, can sell bonds, which is a form of borrowing).
2. Fund the project from existing earnings.
3. Sell additional stock or ownership shares in the company.

If a company borrows money, it must pay back the amount it borrowed plus additional interest. The ***interest*** is a percentage of the amount of the loan that has not been repaid. The repayment of the loan and interest is usually paid quarterly or annually. To qualify for selection, a project that is intended to make or save money must be able to do the following:

- Repay loans if money must be borrowed to fund the project
- Increase future earnings for shareholders
- Make the company stock more valuable

When senior managers at a for-profit company decide which projects to fund, they must consider these economic issues.

Simple Payback

To help managers choose between projects, they can use an unsophisticated measurement called ***simple payback***. If the purpose of the project is to improve **cash flow**—make it more positive or less negative—the improved positive **cash flow** each year is applied to the original cost (negative cash flow) of the project to determine how many years it would take to pay back the original cost. It is assumed that after that date, the improved **cash flow** could be used for other purposes or paid out to owners. For example, if the company borrows $100,000 to fund the project and the project increases cash flow by $20,000 a year, the **simple payback** would be five years, as shown in Figure 7.2.

Figure 7.2 **Simple Payback**

Year	0	1	2	3	4	5	6
Expense	$(100,000)						
Income/Savings		$ 20,000	$ 20,000	$ 20,000	$ 20,000	$20,000	$20,000
Annual Cash Flow	$(100,000)	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$20,000	$20,000
Cumulative Cash Flow	$(100,000)	$(80,000)	$(60,000)	$(40,000)	$(20,000)	$ –	$20,000

The **cash flow** from each year is summed up in the cumulative cash flow row. When the cumulative cash flow becomes zero or positive, it means that the original cost has been paid back by the increased income or savings created by the investment.

Companies can use **simple payback** to establish a cutoff for project consideration. For example, management could declare that no projects will be considered that have a payback of more than three years. For projects that meet this criterion, projects with shorter **simple payback** periods would have an advantage in the selection process. Not-for-profit or government organizations are likely to approve projects with longer **simple payback** periods because they are not compared to other not-for-profit or government agencies based on their profitability.

Internal Rate of Return

Companies whose mission is to make a profit are usually trying to make more profit than their competitors. Simply paying back the loan is not sufficient. If the project involves buying and installing equipment to make a profit, executives can use another method called ***internal rate of return (IRR)***. The IRR is like an internal interest rate that can be used to compare the profitability of competing projects. To calculate an IRR, the company considers the **cash flow** each year for the expected life of the product of the project. It assumes that some of the annual cash flows will be negative and that they can vary from year to year due to other factors, such as lost production during changeover, periodic maintenance, and sale of used equipment. For example, a company decides to upgrade a manufacturing line with new equipment based on new technology. They know that the initial **cash flow**—shown in year zero—will be negative due to the expense of the conversion. They know that the new equipment has an expected life of six years before newer technologies make it out of date, at which time they can sell it for a certain salvage value. The inputs to the IRR calculation are the net **cash flow** for each year where at least one of them is negative and at least one of them is positive. The result is a percentage that indicates how well this project performs as an investment. (See Figure 7.3.)

Figure 7.3 The internal rate of return measures the profitability of an investment.

Year	0	1	2	3	4	5	6
Equipment Cost, Maintenance, Salvage	$(100,000)						$10,000
Income/Savings		$ 20,000	$ 20,000	$ 20,000	$ 20,000	$20,000	$20,000
Annual Cash Flow	$(100,000)	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$20,000	$30,000
Cumulative Cash Flow	$(100,000)	$(80,000)	$(60,000)	$(40,000)	$(20,000)	$ –	$30,000
Internal Rate of Return (IRR)	8%						

The life of the equipment is part of the IRR calculation. If a project manager knows that senior management intends to sell the equipment in six years, team members can be made aware of that decision if it affects their choices.

Other Selection Criteria

Besides making money, there are many other reasons for a project to be selected, including the following:

- Keeping up with competitors
- Meeting legal requirements, such as safety or environmental protection
- Improving the organization's public image

The timing of the project can be very important. A project might be selected at a particular time of year for some of the following reasons:

- Accumulating a year-end budget surplus
- Increasing executive bonus for the year or quarter
- Funding or certification review deadline

If the project manager must make changes to the schedule at some point in the project that could affect its completion date, it is valuable to know if the project was selected because of timing.

Project Champions and Opponents

In addition to knowing why a project was selected, it is valuable to know which senior executives supported or opposed the selection of the project and if the project manager's supervisor was in favour of it or not. Because most project teams consist of people who do not report to the project manager but who report to other unit managers, they might not be available when you need them if their boss thinks other projects are more important. If a particular executive proposed the project and actively advocated for its approval, that person could be a source of support if the project runs into trouble and needs additional resources. A project champion, sometimes called an executive sponsor, is an influential person who is willing to use his or her influence to help the project succeed.

To identify the advocates and opponents of the project, you can read public documents (if available), such as the minutes of the meeting at which the project was approved. Next, the project manager can use his or her unofficial network of trusted colleagues to get their opinions. Those discussions should be informal and off the record. Those opinions might be inaccurate, but it is valuable to know what misunderstandings exist about a project. If executives in an organization are assigned as **project sponsors**, the project champion might be a different person.

Project Champions Support Employee Performance Training

A large organization hired an instructional design team to improve employee performance. The project took over a year to complete and faced some setbacks due to resistance from middle management. During the course of the project, some department managers were frustrated with the time needed for the project team's assessments, interviews, and test implementations, which interrupted the normal course of business. Some of the project team's findings also indicated a need for specialized training, which put a greater burden on individual departments and the department managers balked at taking on this additional workload.

However, due to the organization director's priority of performance improvement, the project team had the support and authority to continue. If upper management did not reinforce the efforts of the project team, the department managers would have greatly inhibited the progress of the project. Ultimately, the project was a success and the department managers realized that the temporary upset to the status quo yielded exponential benefits to the organization as a whole.

KEY TAKEAWAYS

- A mission statement declares the purpose of the organization and identifies the primary stakeholders, the products or services offered, and the responsibility toward the stakeholders. Goals are statements of direction for the organization, and objectives are activities that achieve those goals with measurable outcomes.
- Profit-making organizations exist to make profits for their owners while in competition with other companies. Not-for-profit organizations are directed at providing a service to a particular group. A government agency is similar to a not-for-profit organization, but its sources of funding are usually taxes, fees, and funding from a higher level of government, and it has a responsibility to the citizens it represents.
- Two economic tools for evaluating and comparing projects are **simple payback** and internal rate of return. **Simple payback** is a calculation of the year when the cumulative income or savings due to spending money on a project will meet or exceed the original cost of the project. **Internal rate of return** is a calculation of the average percentage of increased **cash flow** over the life of the project's product.
- Project selection depends on the availability of funds, which depends on the way each type of organization receives money for projects. Funds might be available at certain times and projects are selected that can take advantage of that opportunity. Projects might be initiated for reasons that are not stated, and investigating the source of funding and likely motivation of project champions can provide better understanding of the project's chances for success.
- A project champion is an influential person who is willing to use his or her influence to help the project succeed. It is useful to know why the project champion wants the project to succeed and to be sure to accomplish that goal even if it is not stated.

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[1] http://graduatestudies.byu.edu/node/2335

7.2 Project Scope

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe how the **project scope** is affected by project complexity.
2. Identify the uses of a scope document.
3. Describe how a scope document is developed and changed.

Definition of Scope and the Effects of Complexity

Recall from Chapter 1 that the scope document (also called the scope of work document) defines the ***project scope***—what tasks the project team is expected to accomplish and, just as importantly, what is not part of the project. Depending on the complexity level of the project, the scope document can be as short as one page or as long as several hundred pages. On more technical projects (like the submarine project described in Dr. Gibbons' video), the scope would include a significant amount of technical specifications (such as focusing on the equipment used to find the submarines). The size and character of the **project scope** document is related to the project complexity. Higher scores on the **Darnall-Preston Complexity Index** indicate the need for more detailed scope documents.

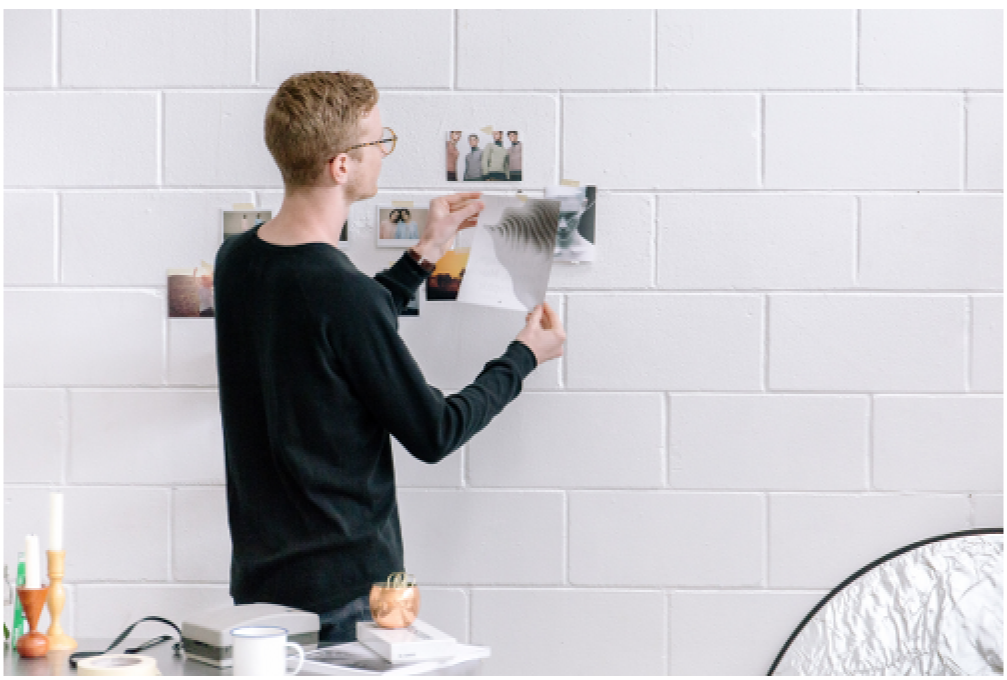

Image by benchaccounting

Uses of a Scope Document

A well-developed project scope statement provides the project team with information the team needs to design and implement the project execution plan. The well-developed **project scope** also provides the team with an understanding of the purpose of the project and the basis for defining project success.

Scope Document for Training Auto Workers

An automotive company is building a new plant to produce electric passenger cars in the southeast United States. As the plant nears completion, the plant's manager issues a contract to an instructional design firm to train the new plant workers. The training of workers who will be maintaining the production equipment will be done by the equipment **suppliers** and will not be in the scope of the training contract.

The scope of work for the training project will include the identification of the knowledge, skills, and abilities needed by each classification of worker and the development of the delivery methods (online, classroom, hands-on) that will effectively and efficiently teach the identified knowledge, skills, and abilities. The scope will also include delivery of the training, evaluation of the workers after training, and the development of training records. Items not included in the **project scope** are items that will be the responsibility of the automotive company, such as the selection and hiring of the workers and the provision of the automotive tools and equipment needed for training. These exclusions are specifically stated in the scope document.

During the design of the plant, the Human Resources Division of the company explored different workforce models. Experience in other plants indicated that a team-based approach combined with a lean manufacturing philosophy produced the highest productivity. This information was included in the documents provided to the team developing the training project's scope. The plant manager, the human resources manager, and the plant engineer reviewed and occasionally made changes to the draft training scope.

The scope of work for the training project was developed from a combination of information from experts with previous experience, documents that reflected the plant operation philosophy, and selected managers from operations and human resources. All the knowledge needed to develop the scope was within the automotive project team. Sometimes outside consultants are needed to develop a complete **project scope**. For example, if the team in our automotive training example did not have experience in the start-up of another automotive plant, then the hiring of a consultant with that experience might have been required to understand the entire scope of activities needed for training the automotive workforce.

The automotive project described above is a typical example of the types of information and the people involved in developing a **project scope**. From the information in the project description, the project team could develop a **project scope** document.

Development and Management of a Scope Document

The project manager will often develop the first draft of the **project scope** and then solicit feedback and suggestions from the project team, client, and sometimes key vendors. The project manager will attempt to develop consensus around the **project scope**, but the final approval belongs to the project client or sponsor. Depending on the complexity profile of the project, the development of the **project scope** document can be a short discussion between the project manager and the client, or on a large, complex project, the process can take weeks.

The **project scope** is not a stagnant document, and changes are to be expected. Changes to the **project scope** are necessary to reflect new information. Changes to the **project scope** also create the opportunity for new purposes to emerge that will change the end results of the project. In some cases, these new results represent a positive outcome for the **chartering organization**.

Deviation versus Change

If a minor change is made to the schedule that does not affect the completion date of the project, it is a deviation from the schedule. As long as the end date of the project or major objectives are not delayed, a formal change request to the client is not needed. Recording and communicating these schedule deviations is still important for coordinating resources and maintaining the client's awareness of the project's progress.

Deviation of Educational Materials Cost

In our example above, the cost of educational materials for employee training was estimated at fifteen dollars per training packet. The winning bid for the printing contract actually quoted a cost of sixteen dollars per packet. The cost deviated from the estimate and a change was made to the budget. This was a cost deviation, not a change in scope. The additional cost for the materials was covered from the project **contingency reserves**, and the budget was revised to reflect the changes.

New Boss Causes a Change to the Schedule

The client hired a new boss who wants something completely different from what was decided upon under the old management. This is an actual change of scope that requires a change request because it changes the budget, the timeline, and the materials needed.

Documenting Changes

It is important to have a written record of changes to the scope of a project. On the least complex projects, an e-mail message can be sufficient, but on larger projects a standard form is normally used. The following steps are paraphrased from Tom Mochal,[1] and they have the necessary components of a change documentation process:

- Inform project stakeholders of the change request process.
- Require that the change request is made in writing, including the business value of the change to the project.
- Enter the request into a ***scope change log***, a record that should be kept to track changes (remember – "Document, document, document!").
- Estimate the time needed to evaluate the change. If the evaluation process is time consuming and would affect activity completion dates by diverting management resources, get approval from the **project sponsor** to evaluate the change request. If the evaluation is not approved, record the decision in the **scope change log**.
- Evaluate the change and its impact on the schedule and budget if the evaluation is approved.
- Present the change request to the **project sponsor** for approval. Record the decision in the **scope change log** with the recommended course of action.
- Distribute the **scope change log** periodically to team members so they know what changes are being considered and what happened to those that were not approved or evaluated.
- If the change is approved, update the project charter or other initiation documents.
- Update the work plan.
- Distribute the revised work plan to stakeholders and team members.

KEY TAKEAWAYS

- Scope is a description of the major tasks that are included in the project and some of the tasks that are specifically not included. More complex projects require more detailed and specific scope documents.
- A scope document is used to provide the project team with the information it needs to design and implement the project plan. It provides understanding of the purpose of the project and what project success would be.
- The scope document begins as a draft that is circulated for comments by the team, client, and in some cases, key vendors. The final draft is approved by the client or sponsor. Changes to the scope must be approved by the **project sponsor** or client and are documented carefully using standard forms and processes.

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[1] Tom Mochal and Jeff Mochal, Lessons in Project Management (Berkeley, CA: Apress, 2003).

7.3 Project Start-Up

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify the major activities included in project start-up.
2. Explain how the project start-up activities may differ on a highly complex project.

The parent organization's decision-making process influences when start-up activities of the project will take place. The transition from planning to project initiation is typically marked by the decision to fund the project and the selection of the project manager. However, be aware that the selection of the project manager is not always the defining event. Some organizations will have the project manager involved in project evaluation activities, and some select the project manager after the decision to fund the project has been made. Including the project manager in the evaluation process enables the project manager to have an understanding of the selection criteria that he or she can use when making decisions about the project during later phases. Selecting the project manager prior to a complete evaluation also includes some risks. The evaluation of the project may indicate a need for project manager skills and experiences that are different from the project manager who is involved in the evaluation.

Selecting the best project manager depends on how that person's abilities match those needed on the project. Those skills can be determined using the **Darnall-Preston Complexity Index (DPCI)**. If the project profile indicates a high complexity for external factors and a medium complexity for the project's technology, the profile would indicate the preference for a project manager with good negotiation skills and an understanding of external factors that affect the project. Because of the technological rating, the project manager should also be comfortable in working with the technical people assigned to the project. The project manager involved in the project selection process may not be the best match for the project execution.

During the start-up of a project, the project manager focuses on developing the project infrastructure needed to execute the project and developing clarity around the project charter and scope. Developing the project infrastructure can be a simple task on a project with a low complexity level. For example, the project manager of a worker training project in Saskatchewan who works for a training college has existing accounting, procurement, and information technology (IT) systems in the college that he or she can use. On large complex projects, a dedicated project office, IT system, and support staff might be needed that would be more challenging to set up. For example, on a large project in South America, the design and operations offices were set up in Canada, Chile, and Argentina. Developing compatible IT, accounting, and procurement systems involved a high degree of coordination. Acquiring office space, hiring administrative support, and even acquiring telephone service for the offices in Argentina required project management attention in the early phases of the project.

Image by Christina Wocintechchat-com

The project manager will conduct one or more kickoff meetings to develop plans for the following activities:

- Establish the project office
- Develop project policies and procedures
- Begin refining the scope of work, the schedule, the budget, and the project execution plan

Depending on the complexity level of the project, these meetings can be lengthy and intense. Tools such as work flow diagrams and responsibility matrices, as defined in Chapter 8, can be helpful in defining the activities and adding clarity to project infrastructure during the project start-up.

Typically, the project start-up involves working lots of hours developing the initial plan, staffing the project, and building both internal and external relationships. The project start-up is the first opportunity for the project manager to set the tone of the project and set expectations for each of the project team members. The project start-up phase on complex projects can be chaotic, and the project manager must be both comfortable in this environment and able to create comfort with the client and team members. To achieve this level of personal comfort, the project manager needs appropriate tools, one of which is an effective **alignment process**. This is one of the reasons there are a large number of meetings during the start-up of projects with a high-complexity profile.

KEY TAKEAWAYS

- The major activities included in project start-up are selecting the project manager; establishing funding; developing project infrastructure such as accounting, procurement, and IT; holding a kickoff meeting, determining staffing; and building relationships.
- The start-up activities for small projects can utilize existing infrastructure for support functions and can have a single start-up meeting, while larger projects require more dedicated infrastructure and full-time staff, and the start-up meetings can take longer and involve more people.

7.4 Alignment Process

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify the purpose of the **alignment process**.
2. Identify the components of the **alignment process**.
3. Identify the effects of a lack of trust on a project.

Developing a common understanding among the key stakeholders of the purpose and goals of the project and the means and methods of accomplishing those goals is called the ***alignment process***. It is important to accomplish this alignment during the **initiation phase**. Project managers usually conduct a start-up meeting that is sometimes called a kickoff meeting. The agenda and duration of the start-up meeting depends on the complexity level of the project. Projects with a limited scope and short duration may engage in a session start-up meeting over lunch. A medium-complexity project will require a four-hour meeting or more while a high-complexity project cannot achieve alignment in a single meeting. Alignment can require several days of activities.

Enhance Alignment Meetings

On one large, complex project, the project alignment required a five-day process. Over twenty members of the project team and client participated in this alignment. To create a relaxed atmosphere and facilitate an open discussion, the alignment meetings and activities were held on a horse ranch in Montana.

A number of companies specialize in designing and facilitating alignment sessions for large, complex projects. Although designed to meet the needs of each project, alignment sessions have some common agenda items:

- Developing a common understanding of the project purpose
- Agreeing on the means and methods for accomplishing the purpose
- Establishing trust among team members

Common Understanding

A common understanding does not mean building a consensus. People may disagree with the direction being developed, but they have the same basic understanding as to the purpose of the project. For a project plan to be effective, there must be a critical mass or sufficient commitment among the critical stakeholders. Therefore, disagreement is not fatal to the project execution, but a unified team with a common understanding is much more powerful and increases the likelihood of success. If disagreement does exist, an open and forthright discussion will enable the project leadership to address the disagreement in developing the project plan. If the disagreement stays hidden and is not openly discussed, problems will emerge later in the project.

Developing a common understanding can be as easy as an informal discussion that lasts a few hours, or it can be a lengthy, complex process. The methods and processes employed to develop a common understanding are directly related to the complexity of the project. The more complex projects will require more intense discussions around those issues that score high on the complexity profile.

Developing a common understanding among the key project stakeholders requires the following:

- Defining project success
- Determining potential barriers to success
- Establishing key milestones
- Identifying decision makers and the decision-making process

It is difficult to execute a successful project without first defining what makes a successful project. The first part of this discussion is easy: the project must be completed on time, within budget, and to all specifications. The next level of the discussion requires more reflection. During this discussion, reflection on the organization's mission, goals, and related issues such as safety and public perception of the project emerge.

After the team develops a common understanding of project success, a discussion of barriers to achieving that success enables team members to express skepticism. On more complex projects, the goals of a project often seem difficult to achieve. A discussion by the team of the potential barriers to project success places these concerns out in the open where team members can discuss and develop plans to address the barriers. Without this discussion, the perception of these barriers becomes powerful and can have an effect on project performance.

Project Purpose

The project purpose is sometimes reflected in a written charter, vision, or mission statement. These statements are developed as part of the team development process that occurs during the project **initiation phase** and results in a common understanding of the purpose of the project. A **purpose statement** derived from a common understanding among key stakeholders can be highly motivating and connects people's personal investment to a project purpose that has value.

A ***purpose statement***—also called a charter, vision, or mission—provides a project with an anchor or organizational focus. Sometimes called an anchoring statement, these statements can become a basis for testing key decisions. A **purpose statement** can be a powerful tool for focusing the project on actions and decisions that can have a positive impact on project success.

For example, a **purpose statement** that says that the project will design and build a free educational website for high-school students will influence meeting educational goals, designs appropriate for cognitive development levels, the cost, etc. When designers are deciding between different types of materials or instructional methods, the **purpose statement** provides the criteria for making these decisions.

Image by Mehrad Vosoughi

Developing a common understanding of the project's purpose involves engaging stakeholders in dialogue that can be complex and in-depth. Mission and vision statements reflect some core values of people and their organization. These types of conversations can be very difficult and will need an environment where people feel safe to express their views without fear of recrimination.

Goals

Goals add clarity to the anchor statement. Goals break down the emotional concepts needed in the development of a **purpose statement** and translate them into actions or behaviours, something we can measure. Where **purpose statements** reflect who we are, goals focus on what we can do. Goals bring focus to conversations and begin prioritizing resources. Goals are developed to achieve the project purpose.

Developing goals means making choices. Project goals established during the **alignment process** are broad in nature and cross the entire project. Ideally, everyone on the project should be able to contribute to the achievement of each goal.

Goals can have significantly different characteristics. The types of goals and the processes used to develop the project goals will vary depending on the complexity level of the project, the knowledge and skills of the project leadership team, and the boldness of the project plan. Boldness is the degree of stretch for the team. The greater the degree of challenge and the greater the distance from where you are to where you want to be, the bolder the plan and the higher the internal complexity score.

Clarity of Objectives Saves Money

A critical online instructional resource was being developed for a project in Michigan. Designers determined that a software upgrade would enable the resource to be developed one month earlier, but at a cost higher than was allocated in the budget. Earlier in the project it was determined that any delays would cost the project over $100,000 per month. Because the objectives of the project were well understood, the decision to obtain the more expensive software was made quickly and easily.

Roles

Role clarity is critical to the planning and execution of the project. Because projects by definition are unique, the roles of each of the key stakeholders and project leaders are defined at the beginning of the project. Sometimes the roles are delineated in contracts or other documents. Yet even with written explanations of the roles defined in documents, how these translate into the decision-making processes of the project is often open to interpretation.

A discussion of the roles of each entity and each project leader can be as simple as each person describing their role and others on the project team asking questions for clarification and resolving differences in understanding. On less complex projects, this is typically a short process with very little conflict in understanding and easy resolution. On more complex projects, this process is more difficult with more opportunities for conflict in understanding.

One process for developing role clarification on projects with a more complex profile requires project team members, client representatives, and the project's leadership to use a flip chart to record the project roles. Each team divides the flip chart in two parts and writes the major roles of the client on one half and the roles of the leadership team on the other half. Each team also prioritizes each role and the two flips charts are compared.

This and similar role clarification processes help each project team member develop a more complete understanding of how the project will function, how each team member understands their role, and what aspects of the role are most important. This understanding aids in the development or refinement of work processes and approval processes. The role clarification process also enables the team to develop role boundary spanning processes. This is where two or more members share similar roles or responsibilities. Role clarification facilitates the development of the following:

- Communication planning
- Work flow organization
- Approval processes
- Role boundary spanning processes

Means and Methods

Defining how the work of the project will be accomplished is another area of common understanding that is developed during the alignment session. An understanding of the project management methods that will be used on the project and the output that stakeholders can expect is developed. On smaller and less complex projects, the understanding is developed through a review of the tools and work processes associated with the following:

- Tracking progress
- Tracking costs
- Managing change

On more complex projects, the team may discuss the use of project management software tools, such as Microsoft Project, to develop a common understanding of how these tools will be used. The team discusses key work processes, often using flowcharts, to diagram the work process as a team. Another topic of discussion is the determination of what policies are needed for smooth execution of the project. Often one of the companies associated with the project will have policies that can be used on the project. Travel policies, human resources policies, and authorization procedures for spending money are examples of policies that provide continuity for the project.

Trust

Trust on a project has a very specific meaning. Trust is the filter that project team members use for evaluating information. The trust level determines the amount of information that is shared and the quality of that information. When a person's trust in another person on the project is low, he or she will doubt information received from that person and might not act on it without checking it with another source, thereby delaying the action. Similarly, a team member might not share information that is necessary to the other person's function if they do not trust the person to use it appropriately and respect the sensitivity of that information. The level of communication on a project is directly related to the level of trust.

Trust is also an important ingredient of commitment. Team member's trust in the project leadership and the creation of a positive project environment fosters commitment to the goals of the project and increases team performance. When trust is not present, time and energy is invested in checking information or finding information. This energy could be better focused on goals with a higher level of trust.[1]

Establishing trust starts during the **initiation phase** of the project. The kickoff meeting is one opportunity to begin establishing trust among the project team members. Many projects have team-building exercises during the kickoff meeting. The project team on some complex projects will go on a team-building outing. One project that built a new pharmaceutical plant in Puerto Rico invited team members to spend the weekend spelunking in the lime caves of Puerto Rico. Another project chartered a boat for an evening cruise off the coast of Halifax, Nova Scotia. These informal social events allow team members to build a relationship that will carry over to the project work.

KEY TAKEAWAYS

- The purpose of the **alignment process** is to develop a common understanding of the purpose, agree on the means and methods, and establish trust.
- The components of the **alignment process** are discussions of the purpose, goals, participant roles, methods of tracking progress and costs, methods of managing change, and building trust.
- The effects of a lack of trust are delays caused by fact checking or missing information that was not shared because the person's discretion was not trusted to handle sensitive information.

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[1] Marsha Willard, "Building Trust: The Relationship Between Trust and High Performance," Axis Advisory 1999, http://www.paclink.com/~axis/M7trust.html.

7.5 Communications Planning

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the differences between communications in an existing organization compared with a new project.
2. Describe how the detail of the communications plan is related to the complexity of the project.
3. Describe a **communication matrix** and its function.
4. Describe conventions for naming files to indicate their content and the version.

When a person joins an existing organization, one of the early tasks is to learn the work processes of the organization, including where to find information, the meeting schedule, and what reports are required. In existing organizations, new members discover the gatekeepers of information: those persons in the organization who know how to generate or find information. Typically, the generation, flow, and storage of information reflects the organizational culture, and to effectively communicate in an organization, a person must be able to develop communication styles and processes consistent with that organization.

Image by Rodnae Productions

Projects do not have the advantage—or sometimes the disadvantage—of an existing organizational culture or communication structure. The project leadership team develops an understanding of the information needs of the various members and stakeholders of the projects and develops a communications plan that provides the right information, at the right time, to the right people.

The detail of the communications plan is related to the complexity level of the project. Highly complex projects require a detailed communications plan to assure that the information needed by the project team and stakeholders is both generated and distributed to support the project schedule and project decisions. Crucial information can be lost or delayed in a complex project if the communications plan is not functioning properly.

Communicating Priorities

During a project in Tennessee, the project management team was exploring ways to complete the project earlier to meet the changing requirements of the client. The team identified a number of actions that could create an earlier completion date. The plan required an early delivery of testing materials by, and the team visited the supplier's senior management and agreed to pay a bonus for early delivery of the equipment.

Two weeks later, during a review of the project procurement team progress, the project manager discovered that the organization's procurement department had delayed approvals needed by the supplier because the engineering design was not submitted in the required format. This action effectively delayed the project two weeks and reduced the possibility of the project team meeting milestone requirements for earning a bonus.

The organization's procurement team did not understand the critical nature of this supplier's contribution to an early completion of the project. All the information needed by the organization's procurement team was in the meeting minutes distributed to the entire team. The procurement team did not understand the implications of their work processes, and the result was a delay to the project schedule and a reduction in client satisfaction and project profitability.

Effective communication on a project is critical to project success. The Tennessee project is a typical example of errors that can be created by the breakdown in communication flow. Highly complex projects require the communication of large amounts of data and technical information that often changes on a frequent basis. Even when the information is at the right place and at the right time, the project procurement leader must assist the procurement team in understanding the priorities of the project. On large, complex projects, that procurement lead would not be in the daily communication to subcontractors or vendors. In the Tennessee project example, the procurement leader's unique understanding that came from participation in the project leadership meeting required a more direct involvement with those subcontractors and vendors that impacted the project goals.

An effective project communications plan also does not overload team members and project systems with information that is not useful. Some project managers will attempt to communicate everything to the entire project team. Although this assures that each team member will receive critical information, the large influx of information can make the distillation of the information to the critical and relevant people more difficult for each team member.

Communication Matrix

A Guide to the Project Management Body of Knowledge (PMBOK) describes tools and techniques for identifying project stakeholders, defining their information requirements, and determining the appropriate communication technology. The project includes developing a list of all the people impacted by the outcome of the project and people who can influence the execution of the project, including project team members. The project leadership then generates a list of information needed or requested by each stakeholder.

The project leadership team develops a list of communication methods for gathering and communicating project information. These include a list of reports, meetings, and document flowcharts. The leadership team then typically develops a ***communication matrix*** that details who is included in each project meeting and the distribution of major documents in a table format.

Figure 7.4 Simple Communication Matrix

Title	Scope Statement	Work Breakdown Structure	Budget	Quality	Change Management Procedures	Change Approvals
Project Chartering Committee	✓					
Client Representative	✓	✓	✓	✓	✓	✓
Project Manager	✓	✓	✓		✓	✓
Technology Team		✓		✓		
Finance Team			✓		✓	
Schedule Coordination Team		✓		✓	✓	

Document Control

On large, complex projects, organizing the creation, distribution, and storage of documents is a major and important activity. Organizations that execute a large number of complex projects will often have project document control systems that the project leadership team will adapt for their project. Document control systems distribute, store, and retrieve information that is needed by the project team. Documents originate from the various team members during the planning and execution of the work and then are transmitted to the document team for cataloging, distributing, and storing.

Document control systems have a systematic numbering system that allows a team member to derive information about the document through the document number.

Document Naming Provides Information about the Content

It is useful to have a unified system for naming documents which immediately provides content identification. For example, document names might indicate the category, purpose, author, and date via standardized codes that the project team adheres to. For example, a file named RFQ3.Monitors-Darnall-10.08.2012,rev3 lets team members instantly know this is a procurement document, which item was procured, who it was prepared by, when it was prepared, and what revision number it is.

When a document is expected to be revised over the course of the project, **version control** becomes important. ***Version control*** means labelling each revision which enables the team to understand the latest activity and status of the document (or the activity behind the document). For example, each drawing might be given a unique identification that reflects the type of drawing, the artist, and the version number. Because the design process includes several iterations of the drawings as more information is developed, document control uses an identification that indicates the version of the document. One procedure might be to use letters to indicate the version of the document until the document is approved and then use a number after approval. Therefore, a document with revision D will be the fourth version of the document. The same document with revision 3 means that this is the third revision after the project was approved for construction.

To assure that everyone who should either review or approve the document received a copy, document control develops a distribution list for each type of document. Each person reviews and signs the distribution list and then sends the document to the next person on the list. The design documents, distribution lists, and other project documents are archived by document control for future reference. In the example above, the document was the third revision after the design was approved.

Naming conventions for files and the versions of files should be consistent with the practices of the parent organization or with the client organization so that the files may be archived with files from other projects.

KEY TAKEAWAYS

- In an existing organization, there are gatekeepers who know how to find information, when it is needed, and what reports are required. In a new project, the project manager can create a new flow of information and reporting requirements.
- More complex projects require more sophisticated communications plans.
- A **communication matrix** is a table that shows the names of people as column or row headings and the types of documents as row or column headings. In the cells where the name and document type intersect, a symbol indicates the person's responsibility or access with regard to that type of document.
- File names can be used as codes to describe the contents of the file. Parts of the name can be used to identify the category, location, subject, author, and date. File name conventions should be used that match those used by the parent organization or by the client.

7.6 Interactive Video - Dr. Rick Schwier

Chapter 7 Interactive Review

An interactive version of Dr. Rick Schweir's chapter 7 contribution.

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=1949#h5p-4

CHAPTER 8

8 Project Time Management

8.0 Overview

Visit Audio Recordings for the audio version of this section.
This chapter aligns with Chapter 6 of the PMBOK and 11% of the CAPM questions come from this knowledge area. The content connects to the Planning and Monitoring & Controlling category of the PMP questions.

> "In preparing for battle, I have always found that plans are useless, but planning is indispensable." –Dwight D. Eisenhower

Although stated for a context quite distinct from instructional design, the above quote encapsulates several key truths about planning when it comes to **project management**: A well-structured plan and schedule fulfills an essential role in the completion of successful projects, although it may often be the case that events unfold quite differently from what was originally projected.

The nature of the planning process varies by project. For larger and more complex projects, there may be an extensive planning process with multiple layers of complexity, documentation, and specialized staff; while for smaller projects, the planning process may consist of little more than a regularly updated Excel spreadsheet by a single project manager.

The purpose of this chapter is to provide you with a framework by which to approach planning as a project manager. Project planning and scheduling is both an art and a science. No two project managers or planning professionals develop identical plans or project schedules. The planning process is creative and reflects each planner's approach and style. Even though the project plan is unique to the approach and style of the planner, methods for developing the schedule and documenting the resulting plan typically follow certain patterns. These include:

- Identification of project resources and scope
- Development of a project timeline
- Deciding on project **milestones**
- Determining the schedule of activities

By following these steps the project manager is in better position to successfully guide the project to completion.

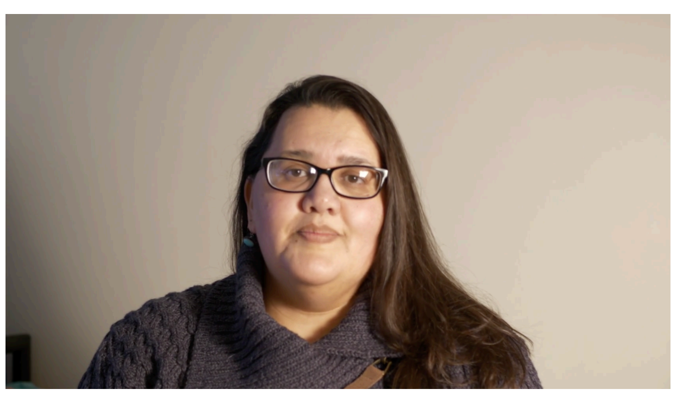
Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=130

Time management in projects, and budget control as a result, you know, because budget and time, same thing in many cases, it's really tricky. And it depends on what you want to do with it. It probably depends on the complexity of your project. I mean, you can get time management software, you can get team management software, you can get all kinds of stuff that will help you break down projects into infinite numbers of many tasks and subtasks. Click here to access transcript

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan



At the distance education unit we have a project timeline that gets created for every course and it's just a really concise way to lay out who's doing what, when, and what everybody's roles are. Click here to access transcript.

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

On this particular project, we were training two different positions: A helicopter pilot and a sensor operator who operated sensitive electronic equipment. We had about 500 different pieces that were being created of media, different kinds of media. Each one had to go through its own little development process. So managing the schedule was figuring out how many of each piece we had to create, how many steps it had to go through, how long each step would take on average, and then doing the multiplication deal. This was, by the way, before the day of spreadsheets, and so we didn't have, this is all done by hand on big sheets of graph paper. But we would build a schedule–actually there are two ways to do a schedule. On this project we were able to manage the schedule that way. We could do a very systematic approach, number of people, amount of time for each step, that kind of thing, and it worked out very well. On another project that I worked on, I did the same thing on a big piece of graph paper that was, here is this many things that need to be created, and here is this many steps, and I actually plotted each piece of thing that had to be created on a certain number of squares on this graph paper. And as the list grew, I still have this chart at home as a reminder that the systems approach doesn't always work. Because I got about half way down the list of things to be produced and I was already at the end of the project and there were still the rest of the things on this plan, the rest of the things had to be produced and it was going to double the time of the project. And so we finally just said, throw it away. We're just going to get it done. We don't know how we're going to get it done, but we're going to get it done. And we just started putting it through, and it worked, we were done on time, satisfied customer.

Heather Bryce – Independent Studies – BYU

At the very beginning, I think the key to Art 45 or any project that you work in is to do as much planning work up front, in making predictions on how long you think something will take a team. A lot of a project is one part of the team will work on their portion of it, and then they'll pass it off to another team. So they're kind of dependent. And so we really try to get together and figure out. Okay, this project started last year in January, so you know, editing would take from January to March, from March to June we would be working on the Flash or the video. I think that's really key, is to plan ahead of time. To make sure that you kind of have a basis schedule and then what I do is, we actually have a program here that is a task management program. So, one person checks off their task. The next person who is supposed to receive the task will have it show up in their dashboard. And then that kind of helps control the flow of processes. And then I check in and remind people, because we have several people on several different teams. So you could be working on several different projects at the same time. So, one of my functions is to check in on people. Have regular meetings and see that we're staying on schedule. Our general guideline for a course is about a year. From beginning, when we're planning the idea to when we finish and it is actually available to students. We try to get it finished within a year, and this course finished within a year.

You know, the BYU Learning Suite because it's such a large project, very complex, lots of different components, scheduling is our biggest difficulty. So, you know, we've got resources we have to schedule, the developers, instructional designers, graphic designers. So the complexity of that was my biggest challenge as a project manager. We always kept running into bottlenecks, the **critical path**, you know, seemed like one person, you know, they'd bounce around. Okay, as soon as we get this problem resolved and this person off the **critical path**, now we've got another one. So initially it was the instructional designers, they've got to get the initial look and feel, and they're working that out with the consultants, we're gathering all the requirements, we're building the initial design. Now we have to throw it over to our graphic designer, and he's got to develop the high fidelity look and feel for the programmers to develop. And they take that look and feel, combine it with the requirements and they know what to program. So, you know, you're going through all those different things and it's like, how hard do you push this person, you know. And one of the constraints that we're working with is we're not a business. I can't say we've got a deadline, I don't care if you have to work 60, 70 , 80 , 90 hours a week, you got to get it done. This is a University where we kind of don't do that. It's not like we're working 40 hour weeks, but we're not working 60 hour weeks, at least not all of us are. Some of us are. So that's the biggest issue is how do you get the schedule in a constrained environment where your resources really are only working this many hours a week, as many as we're paid to work. And so that's the biggest difficulty, but that's true with any project. You have schedules and the resources that you have. And you have to know how hard you can push without pushing so hard that they leave, try to find a better job, they become disgruntled, they become less effective, because you can only work so many hours of peak efficiency work and then it starts dropping off. So you have to balance all those issues whether you are in a University environment or not, but in any instructional project you have almost always limited resources because folks who build instructional products are trainers, product specialists, folks who generally don't have unlimited budgets. So you have a limited amount of budget, a limited amount of time to get things done. So the schedule is often the thing that drives those other things. So you know, we've only got this much money to spend, and we've got this much time, so we're going to get this much done.

8.1 Types of Schedules

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVE

1. Define the types of project schedules.

The schedule develops as the project moves from its early conceptual phase into the execution phase.

Image by Tyler Franta

SCHEDULES

When the scope of the project is being determined, a conceptual simple schedule that shows the major tasks and approximate start and end dates is developed to allow senior management to make decisions about the scope of the project. Detail is not required at this stage because entire tasks might be dropped from the scope, or the whole project might not be approved.

Master

If the project is chosen, a master schedule is created. It has major events and dates such as the starting date and the completion date. The master schedule is often part of a contract. Changes to the master schedule must be approved using a documented change process with approval by the **project sponsor** and client.

Detail

To execute the master schedule, the major activities are broken down into smaller activities and resources are assigned to those activities. The most detailed versions or portions of the schedule may be developed a few weeks prior to the execution of those activities and are called two-week plans. Portions of the master schedule that affect particular vendors might be sent to them so they can provide detailed activities that they would perform.

KEY TAKEAWAYS

- Types of schedules vary in detail. A broad, general conceptual schedule is used in the earliest phases of the project design. A master schedule with start date, **milestones**, and completion date becomes part of the contract and is changed by mutual agreement using a formal change process. Details are added to the master schedule as needed to perform the work of the project activities.

8.2 Elements of Time Management

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe a **work breakdown structure** and how it relates to activities.
2. Describe the use of graphic representations for time management.

According to the Project Management Institute (PMI), project time management includes the following elements:[1]

- Define activities
- Sequence activities
- Estimate activity resources
- Estimate activity durations
- Develop schedule
- Control schedule

The list of activities, their relationship to each other, and estimates of durations and required resources comprise the ***work breakdown structure (WBS)***. The project WBS is a hierarchical—classified according to criteria into successive levels—listing and grouping of the project activities required to produce the deliverables of the project. The WBS represents a breakdown of the project into components that encompass the entire scope of the project. Each level of the WBS hierarchy represents a more detailed description of the project work so that the highest level represents broad categories, and the lower levels represent increasing amounts of detail.

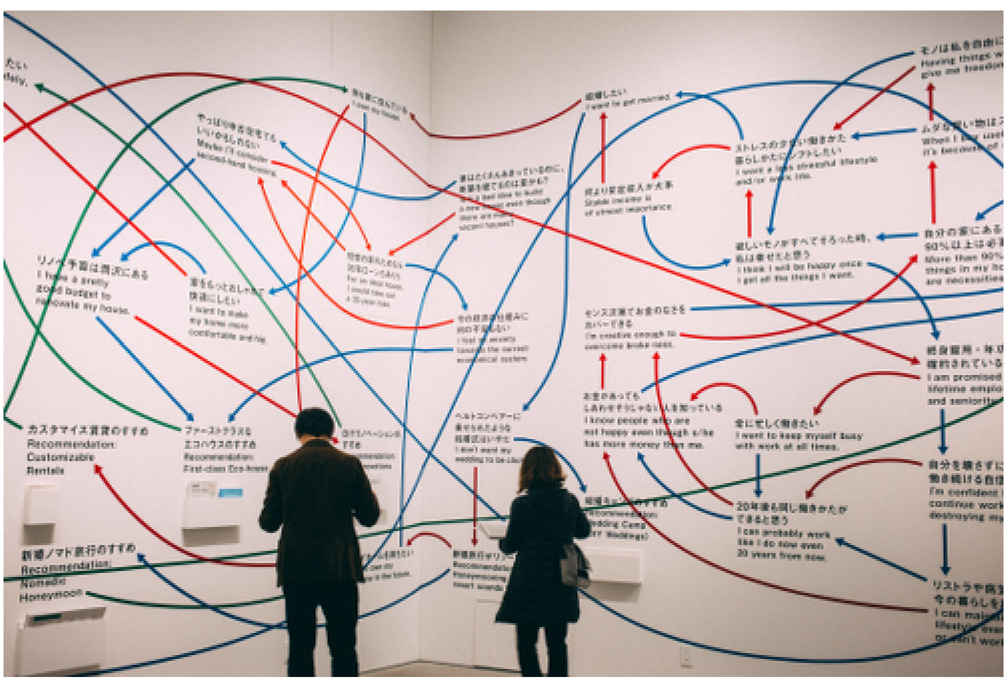


Image by Charles Deluvio

Larger and more complex projects often require a larger WBS. The size of the WBS is directly related to the amount of work on the project and how that work is divided into work packages. The WBS can be developed around the project phases or the project units or functions that will be performing the work. A WBS organized around the project phases facilitates the understanding of the amount of work required for each phase of the project. A WBS developed around the project units or functions of the project facilitates the understanding of the amount of work required for each function.

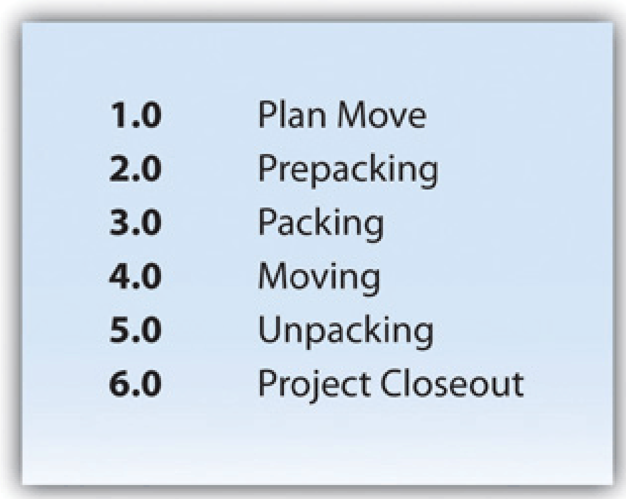
The following example, “John’s move”, will often be used throughout the rest of the book. It has a low level of complexity compared to a larger project and would probably not receive the amount of detailed planning described in the following examples; however, we felt this basic scenario, which is familiar to most people, will demonstrate the concepts that can be applied to any project.

John’s Move

John has a small but important project. He has accepted an instructional design position in Calgary and now has to move from Montreal to Calgary and be there, ready to work, right after the Christmas holidays. If the furniture arrives in good condition at least two days before John starts work, and for less than five thousand dollars, the project will be a success. The move to Montreal five years ago cost five thousand dollars, but John is smarter now and will use his friends to help, so he is confident he can stay within budget.

Developing a WBS begins by defining and developing lists of all activities—work performed on the project that consumes project resources, including cost and time—needed to accomplish the work of the project. The first draft of the WBS includes activities at the highest level of the hierarchy or the management level and typically includes the major activities or summary activities required to accomplish the deliverables identified in the project scope of work. On John’s move project, these top-level activities are numbered 1.0, 2.0, 3.0, and so on, as shown in figure 8.1.

Figure 8.1 Summary Level Activities



One of John’s Summary Level Activities is Packing (3.0). The activity is then decomposed—broken down into smaller units—to the next level by listing the tasks needed to accomplish that step, as shown in figure 8.2. The first subdivision of activities is listed as 3.1, 3.2, and 3.3. The WBS shows a greater level of detail by listing the tasks needed for each subdivision activity, such as 3.3.3 Pack bedroom (which could be decomposed further, such as 3.3.3.1 Pack closet, 3.3.3.2 Pack drawers, etc.). This type of numbering of the activities is called***intelligent numbering***. In **intelligent numbering**, the numbering system has meaning so that a member of the project team knows something about the activity by the number of the activity. For example, any activity associated with packing begins with a 3; even picking up donuts is an activity under packing because the donuts are a form of payment for the packing labour of Dion and Carlita.

Figure 8.2 Major Activity Decomposed into Smaller Activities

3.0 Packing
- **3.1** Confirm Dion's and Carlita's help
- **3.2** Pick up donuts and coffee
- **3.3** Pack apartment
  - **3.3.1** Pack kitchen
  - **3.3.2** Pack living room
  - **3.3.3** Pack bedroom
  - **3.3.4** Pack remaining items

The WBS is developed or decomposed to the level that the manager needs to control or manage the project. In our John's move example, the project schedule may have been just as effective without detailing the packing of the individual rooms in the old apartment. If we deleted these items, would John know when he needed to pack each one of these rooms? If the answer is yes, then we may not need that level of detail.

Estimation of Duration

After the project team has created the WBS, each activity is reviewed and evaluated to determine the ***duration*** (how long it will take to accomplish from beginning to end) and what ***resources*** (time, materials, facilities, and equipment) are needed. An ***estimate*** is an educated guess based on knowledge, experience, and ***inference***—the process of deriving conclusions based on assumptions. The accuracy of the estimate is related to the quality of the knowledge and how that knowledge is applied. The person with the most knowledge may not be the most objective person to provide duration estimates. The person responsible for the work may also want to build in extra time. Multiple inputs into the duration estimate and a more detailed WBS help reduce ***bias***—the making of decisions based on a prejudged perspective.

Duration Estimate for Training

A language training facility recently decided to start teaching Arabic. The language training manager will need to know when the new language materials can be acquired, when the new instructors will start their training on the curriculum and when they can start teaching. The facility's human resources manager will need to know what skills the workers need to teach Arabic and how much time each training class will take. In addition, the HR manager will need to include activities to locate facilities, schedule training, write contracts for trainers, and manage the initiation of training classes. As can be seen, a duration estimate can become very complicated and require an even greater level of detail, which could be measured in days, hours or even minutes.

The unit of time used to develop the activity duration is a function of the level of detail needed by the user of the schedule. Typically, larger and more complex projects require a more detailed WBS—which usually translates into shorter time for the actual activities. The unit of duration is typically working days but could include other units of time such as hours, weeks, or months. The unit chosen should be used consistently throughout the schedule.

Resource Allocation and Calendars

A common resource constraint is availability. To consider the availability of team members, consultants, and vendors, you can create a ***resource calendar*** that indicates which days they are available and which are days off. A calendar for team members from the same company could be the company calendar that shows working days, weekends, and holidays. Individual team members can have individual calendars that show their vacation days or other days off, such as parental leave days. If major pieces of equipment are only available for certain periods of time, they can be given a **resource calendar**.

Resource calendars become important tools when changes must be made to the schedule. When a **resource calendar** is applied to a duration estimate, the duration in days is distributed across the available calendar days. For example, if the duration is three days and the start date of the activity is Thursday, the activity would begin on Thursday and end on Monday of the following week, assuming the **resource calendar** shows that the person has the weekend off. If the weekend included an extra day off for a holiday like Labour Day, the completion day of the same three-day activity would be pushed to Tuesday.

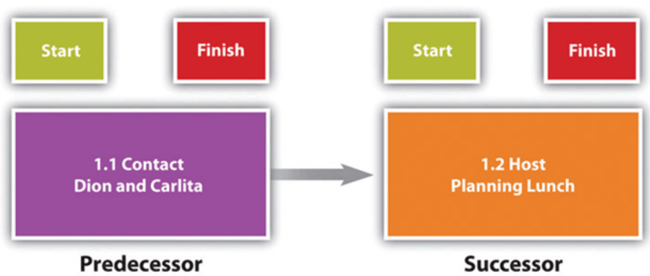
Activity Sequencing

Determining the schedule of a project begins by examining each activity in the WBS to determine its relationship to the other activities. The ***project logic*** is the development of the activity sequence or determining the order in which the activities will be completed. The process for developing the **project logic** involves identifying the predecessors—activities that come before—and successors—the activities that come after.

Project Logic *for John's Move*

In our example of John's move, contacting Dion and Carlita—activity 1.1—comes before the lunch meeting is scheduled. You must logically contact Dion and Carlita before you schedule your Host Planning Lunch—activity 1.2. Your conversation with Dion and Carlita will provide you with dates they are available and establish their commitment to help you move. Therefore, the conversation with Dion and Carlita is a predecessor to the Host Planning Lunch Activity. This relationship is diagramed below.

Figure 8.3 Relationship between Two Activities

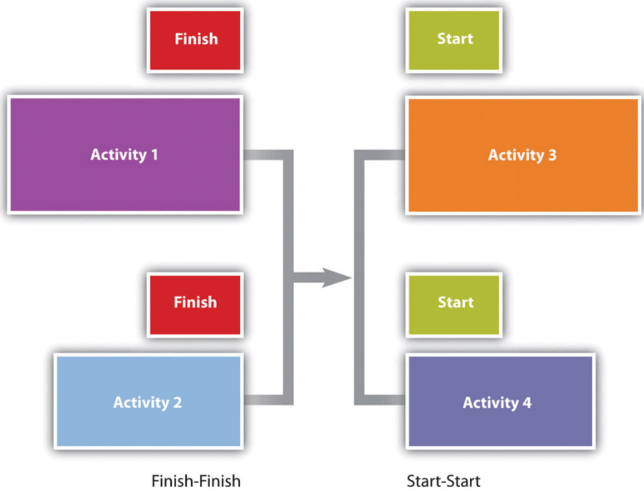


These terms define a relationship that is similar to a family relationship like father and son. The father exists in time before the son. Similarly, each element of the diagram can have predecessor-successor relationships with other elements, just like a father can be the son of someone else. Additionally, just as the son has a mother as well as a father, activities can have more than one predecessor.

The relationship between a predecessor activity and a successor activity is called a ***dependency***. The successor activity starts after and is dependent on the predecessor activity. Because the conversation with Dion and Carlita must take place before a planning meeting can be scheduled, this is called a ***natural dependency*** because the relationship can be inferred logically. Activities that have predecessor-successor relationships occur sequentially—one after the other. Another term for this type of relationship is ***finish-start*,** which means the first activity must finish before the next one can start. (Refer to the figure 8.3.) Because the **finish-start relationship** is by far the most common, the type of relationship is assumed to be finish-start unless otherwise mentioned.

Some activities take place concurrently—at the same time. If they must begin at the same time, they have a ***start-start*** **relationship**. If the activities can start at different times but they must finish at the same time, they have a ***finish-finish*** relationship. (Refer to Figure 8.4.)

Figure 8.4 Start and Finish Relationships



Concurrent activities can be constrained to finish at the same time or start at the same time.

Figure 8.5 shows the activities in John's move with the predecessors identified for the Plan Move and Prepacking groups of activities.

Figure 8.5 Outline of Activities with Predecessors Identified

				Predecessors
1.0	Plan Move (Project Start)			
	1.1	Contact Dion and Carlita		
	1.2	Host planning lunch		**1.1**
	1.3	Develop and distribute schedule		**1.2**
	1.4	Make hotel arrangement in Atlanta		**1.1**
2.0	Prepacking			
	2.1	Gather packing material		
	2.2	Select moving van company and sign contract		
		2.2.1	Contact 3 moving van companies and get bids	**1.3**
		2.2.2	Select company and negotiate a final price	**2.2.1**
		2.2.3	Sign moving contract	**2.2.2**
	2.3	Pack small delicate items		**1.3,2.1**

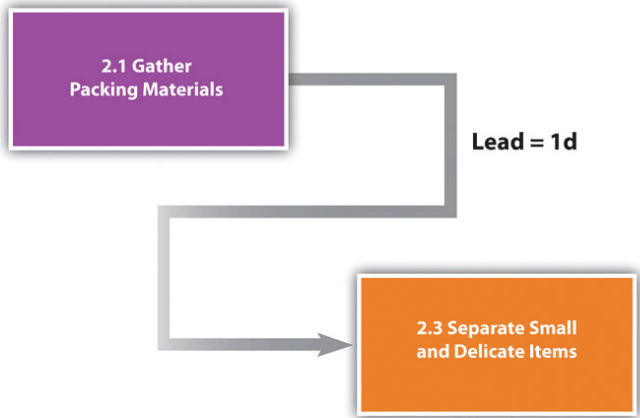
Lag and Lead Times

As stated before, most activities in a network diagram have a **finish-start relationship**. If a certain amount of time must go by before a successor activity can begin, the required delay is called***lag time***. In some cases, the successor activity can overlap the end of its predecessor activity and begin before the predecessor is finished. This is called ***lead time***.

Lead Time in John's Move

In John's move, you might begin separating the small and delicate items that will be packed in step 2.3 before you get the packing materials in step 2.1 so that when the materials are available, step 2.3 is already partially completed. If preparing the small items for packing can overlap its predecessor and shortens the time it takes to accomplish both tasks by a day, it has a **lead time** of one day.

Figure 8.6 **Lead Time**



The characteristics and identifiers of an activity are its ***attributes***. At this point in the process of analyzing John's move, each activity has an identifying code, a short description, predecessors, and lead or lag times, as shown in a partial table of activities in Figure 8.7.

Figure 8.7 Table of Attributes

Code	Description	Predecessors	Relationships	Lead/Lag
1.1	Contact Dion and Carlita	None		0
1.2	Host planning lunch	1.1	FS (Finish/Start)	0
1.3	Develop and distribute schedule	1.2	FS	0
1.4	Make hotel arrangement in Atlanta	1.1	FS	0
2.1	Gather packing material	None		0
2.2.1	Contact moving van companies and get three bids	1.3	FS	0
2.2.2	Select company and get final price	2.2.1	FS	0
2.2.3	Sign moving contract	2.2.2	FS	0
2.3	Pack small and delicate items	1.3 2.1	FS FS	1

Milestones

Milestones are significant events in your project which consume no resources and have no duration. **Milestones** are usually indicated on the project schedule with a diamond and often have a vertical line on a time-scaled graph to show the relationship of various schedule paths to the milestone. An effective **milestone schedule** will capture the major constraints to the project schedule and provide a summary level overview of the project.

In our John's move project, we might create a milestone called "all packing complete" to represent the date when everything is packed and ready for the moving van. Any delay in this date will mean a delay in the arrival of the moving van in

Chicago, a delay in the arrival of the moving van in Atlanta, and a delay of all the unpacking and other downstream activities (see Figure 8.8, "Gantt Chart").

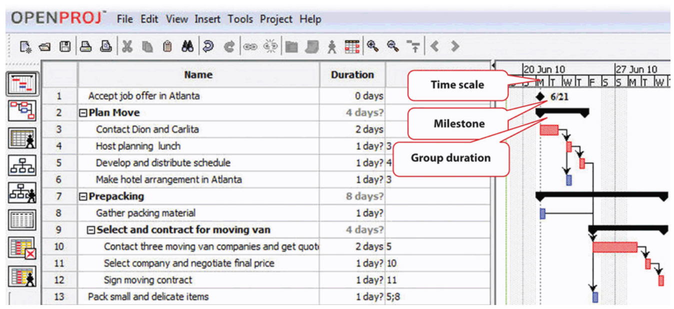
GRAPHIC REPRESENTATIONS

Relationships between activities are easier to recognize if they are presented using graphics such as bar charts or a network of connected boxes.

Gantt Chart

The type of bar chart used to illustrate activity relationships in a project is the ***Gantt chart***. The **Gantt chart** was developed by Henry Gantt and used on major projects, including building the Hoover Dam and the U.S. interstate highway system.[2] The **Gantt chart** is a time-scaled graphic that represents each activity with a bar that reflects the duration, start, and finish time, as shown in Figure 8.8.

Figure 8.8 Gantt Chart

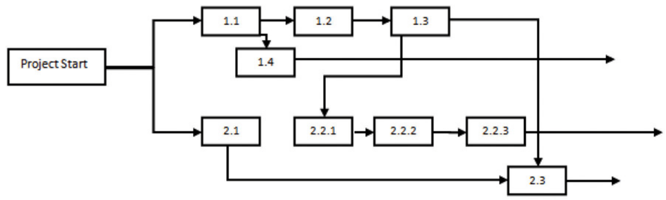


A **Gantt chart** is easy to read and provides sufficient information for project team members to plan activities within a short time frame. For many larger projects, a two-week bar chart, extracted from the larger master schedule, provides the information needed for team members and contractors to coordinate activity details. The **Gantt chart** provides information for simple planning but is limited because a **Gantt chart** does not illustrate complex relationships well.

Network Diagrams

People recognize relationships and patterns more effectively when they look at diagrams like the one in Figure 8.9, "**Project Network Diagram**". The ***precedence diagram method (PDM)*** is a technique for graphically displaying the logic of the schedule by placing the activities in boxes with arrows between them to show the precedence-successor relationships. The boxes in this type of diagram are called ***nodes*** and the arrows indicate **finish-start relationships**. Compare the diagram in Figure 8.9 to the outline in Figure 8.5, "Outline of Activities with Predecessors Identified" to see how much easier it is to trace a sequential path from one activity to the next in the precedence diagram. This type of diagram is also called a ***project network diagram***.

Figure 8.9 **Project Network Diagram**



KEY TAKEAWAYS

- The **work breakdown structure** is a list of activities, including estimates of their durations, their relationships with others, and the resources assigned to them.
- Bar charts are used to indicate durations and sequencing where the relationships are simple. Network diagrams are used to show complex relationships between activities.

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[1] Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008), 129.

[2] Reference.com, "Henry Gantt," http://www.reference.com/browse/wiki/Henry_Gantt (accessed July 27, 2009).

8.3 Critical Path and Float

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVE

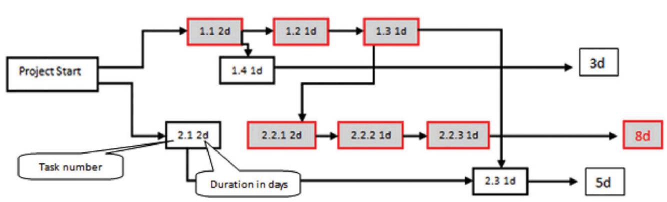
1. Calculate **critical path**, project float, **early start dates**, and late start dates.

The ***critical path*** is the path through the network that results in the latest completion date of the project.

Image by Armin Rimoldi

If any activity on the **critical path** is delayed, the completion of the project will be delayed by an equal amount. To determine the **critical path**, add the amount of time estimated for the duration of each activity to the previous activity, as shown in Figure 8.10. Durations are indicated in days and activities on the **critical path** are shaded. The **critical path** through these tasks takes at least eight days.

Figure 8.10 **Critical Path**



Early Start Dates

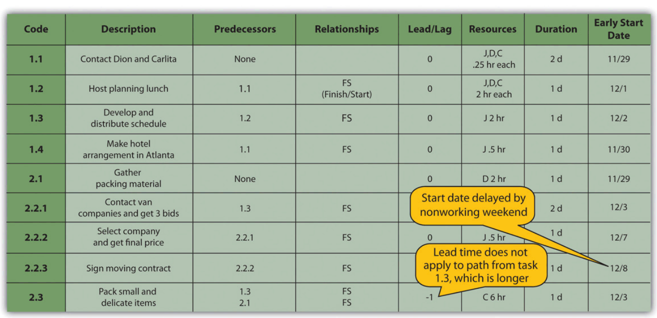
Starting dates can be assigned to each activity by doing a forward pass proceeding from left to right in the network diagram beginning with the project start date. The dates derived by this method are the ***early start (ES) dates***. The **early start date** for an activity is the earliest date the activity can begin. The estimate considers durations and resource availability calendars. To calculate **early start dates**, begin with the project start date and assign that date as the start date of activities that have no predecessor activities. Follow these steps to calculate the **early start dates** of subsequent activities, assuming **finish-start relationships**:

- Add the predecessor activity's duration to its start date.
- Add the **lag time** or subtract the **lead time**.
- Refer to the **resource calendar(s)** that applies to the people and equipment necessary for the activity, and add the number of off-days that the activity would span on those calendars.
- Assign the calculated date as the **early start date** of the successor activity.

Forward Pass for John's Move

John begins planning his move to Calgary the same day he accepts the job. The start date in this example is Monday, November 29, 2010. Tasks 1.1 and 2.1 can both start on that day, so the **early start dates** for tasks 1.1 and 2.1 are November 29. John calculates the **early start date** for the activities. A partial list is provided below. Compare the figure below and the figure in the next sidebar. Observe that John is willing to work on weekends, but activity 2.2.3 is delayed by two days because one of the moving companies did not provide bids on the weekend. Observe that activity 2.3 has a **lead time** of one day, but that relationship is between activity 2.1 and 2.3. The network path from activity 1.3 is longer, so the **lead time** with activity 2.1 is not considered in calculating the **early start date** of 2.3.

Figure 8.11 Early Start Dates Determined by a Forward Pass



Code	Description	Predecessors	Relationships	Lead/Lag	Resources	Duration	Early Start Date
1.1	Contact Dion and Carlita	None		0	J,D,C .25 hr each	2 d	11/29
1.2	Host planning lunch	1.1	FS (Finish/Start)	0	J,D,C 2 hr each	1 d	12/1
1.3	Develop and distribute schedule	1.2	FS	0	J 2 hr	1 d	12/2
1.4	Make hotel arrangement in Atlanta	1.1	FS	0	J .5 hr	1 d	11/30
2.1	Gather packing material	None		0	D 2 hr	1 d	11/29
2.2.1	Contact van companies and get 3 bids	1.3	FS	[illegible]	[illegible]	2 d	12/3
2.2.2	Select company and get final price	2.2.1	FS	0	J .5 hr	1 d	12/7
2.2.3	Sign moving contract	2.2.2	FS	[illegible]	[illegible]	1 d	12/8
2.3	Pack small and delicate items	1.3 2.1	FS FS	-1	C 6 hr	1 d	12/3

Doing this process manually is error prone and time consuming. Fortunately, there are computer programs to assist in the process, but the project manager must understand the process well enough to recognize computer errors. Computer software must be combined with common sense or good judgment.

Float

Float, sometimes called **Slack (float)**, is the amount of time an activity, network path, or project can be delayed from the early start without changing the completion date of the project.

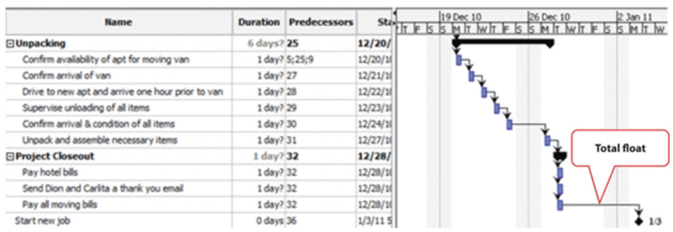
Total float is the difference between the finish date of the last activity on the **critical path** and the project completion date. Any delay in an activity on the **critical path** would reduce the amount of **total float** available on the project. A project can also have***negative float***, which means the calculated completion date of the last activity is later than the targeted completion date established at the beginning of the project.

If activities that are not on the **critical path** have a difference between their **early start date** and their late start date, those activities can be delayed without affecting the project completion date. The float on those activities is called***free float***.

Float in John's Move

The last activity in John's move has an **early start date** of December 28 and a duration of one day. John could start work on Wednesday, December 29. John's first day at work is Monday, January 3, so the project has a **total float** of five days.

Figure 8.12 Total Project Float



Late Start Dates

The next step is to work through the network diagram from right to left beginning with the mandated completion date, which is a milestone that is set in the project plan. Subtract the duration of each activity in each path to determine the latest date the activity could begin and still meet the project completion date. **Resource calendars** must be considered in the backward pass as well as the forward pass.

To calculate late start dates, begin with the project completion milestone and assign that date as the finish date of its predecessor activities. Follow these steps to calculate the late start dates of predecessor activities, assuming **finish-start relationships**:

- Subtract the predecessor activity's duration from its late finish date.
- Subtract the **lag time** or add the **lead time** to the late finish date.
- Refer to the **resource calendar(s)** that applies to the people and equipment necessary for the activity, and subtract the number of off days that the activity would span on those calendars.
- Assign the calculated date as the late start date of the predecessor activity.

The difference between the **early start date** and the late start date for activities on the **critical path** is usually the same as the **total float**, unless the activities are affected by the **resource calendars** differently in the forward and backward pass. For example, if a piece of key equipment is only available for a few days, activities that depend on it have the same start and finish dates in the forward and backward passes.

KEY TAKEAWAYS

- To calculate total project float, begin at the start date and add the duration of each activity in each possible path through the network diagram, including nonworking days from the **resource calendars**, to determine the early project end date. The longest path through the network is the **critical path**. The difference between the early end date and the required completion date of the project is the total project float, and the start date of each activity is the **early start date**. To calculate the late start dates, begin with the required project completion date and work backward, subtracting the duration of each activity though each possible pathway.

8.4 Managing the Schedule

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe methods of tracking and reporting progress.
2. Define **resource levelling**.
3. Describe methods of accelerating the schedule.

To manage a schedule, the project manager must know how the work is progressing compared to the master schedule and, if necessary, make changes to keep the project on time.

TRACKING AND REPORTING PROGRESS

Image by rfstudio

Tracking the schedule performance involves measuring the work performed against the work expected to be performed with a given expenditure of resources. Periodic reporting on the progress of the project provides the project management team with information on how the project is performing against expectations and to make decisions and corrections. Accurate measurement of schedule performance requires planning during the early stages of the project to determine the unit of measure and process for tracking progress.

Reporting Percentage Completed

To determine the percentage of a project that has been completed, the project manager must determine what to measure. Some percentages are misleading. For example, a project that has completed 25% of the scheduled activities does not mean that the project is 25% complete. In our John's move example, four rooms were to be packed. After the bedroom was packed, packing was not 25% complete. The kitchen contained five times as many items and required more delicate, time-consuming packing. John estimated that 40% of the items to be packed were in the kitchen, 20% in the living room, 20% in the bedroom, and the remaining 20% in miscellaneous locations. If the unit of measure for these activities is items packed, the packing is only 20% complete instead of 25% if rooms are the unit of measure.

The unit of measure for tracking schedule progress is related to the estimate. If hours of labour are used as the unit of measure, the percentage of packing is even less because more time is estimated to pack each item in the kitchen. As the project management team estimates the **duration** for each activity, the amount of work to accomplish the tasks is captured in both resources expended and a unit of measure for tracking progress. The unit of measure is related to the type of project. On a software development project, the unit of measure may be lines of code written. The unit of measure that is chosen can affect the quality of the work.

Units of Measure on a Programming Project

Steve Ballmer of Microsoft related early clashes with IBM over the unit of measure used to determine how much Microsoft would get paid for its work for IBM. IBM's standard was to pay per K-LOC, which is a thousand lines of code; Microsoft thought that they should not be paid less if they were able to produce good work in fewer lines of code.[1]

In this case, IBM's insistence on using thousands of lines of code as the unit of measure did not reward Microsoft for writing smaller code that would run faster. Microsoft and IBM cancelled their joint project for writing an operating system named OS/2. Microsoft wrote Windows, and IBM's OS/2 operating system was not able to compete with it successfully.

On a construction project, a unit of measure may be yards of concrete poured, and on a training project, the unit of measure may be the class curriculums developed or the number of students taught.

Managing Schedules Using **Milestones**

Milestones provide the opportunity for project management to focus on completing activities that will have the greatest impact on the schedule. On complex projects, focusing on the **milestones** is useful for communicating important dates to the entire project team. Project team members can then adjust their efforts to complete the activities connected to the milestone events.

Many project leaders believe that time lost on early activities can be made up toward the end of the project. Hard decisions about paying overtime and working weekends are often delayed until the end of the project when the pressure to complete the project on time becomes much stronger. Project managers who focus on milestone events create a sense of urgency to meet the milestone deadlines and spread the urgency to complete the project over the life of the project. Projects that meet milestone dates are more likely to meet project completion dates.

Current Schedule

A schedule update is distributed regularly to provide project **stakeholders** with an assessment of the progress of the project against the master schedule. This updated schedule is called the **current schedule**. The***current schedule*** provides new start and end dates for all activities and the project. Calculations based on the **current schedule** may result in a new **critical path** and subsequent changes in the project execution plan.

The project team develops an understanding of the project productivity by comparing the **current schedule** to the original schedule. If the schedule is behind original estimates, the project team conducts an assessment of the causes of the schedule slippage and develops a plan to address the changes to the project. The project management team typically has several alternatives for addressing changes to the project situation. Selecting the right alternative requires good information.

RESOURCE LEVELLING

The schedule of activities is constrained by the availability of resources. If you apply the **resource calendar** to each activity to be sure the people and equipment are available on those dates, you can still miss an important constraint. If there are several activities that use a particular person's time on the same days, that person could end up with too many activities scheduled for the same days and very little on other days. If key people are overloaded, the activities to which they are assigned might not be completed on time. Managing the schedule of activities to ensure that enough resources are available to complete each task by distributing the work load is called***resource levelling*** . Activities to which that person is assigned and that have **free float** can be delayed to reduce work overload of key people.

ACCELERATING THE SCHEDULE

The project manager must know how to accelerate a schedule to compensate for unanticipated events that delay critical activities or to accommodate changes in the project completion date. Compressing or **crashing the schedule** are terms used to describe the various techniques used to shorten the project schedule. Project managers utilize several techniques to keep projects on schedule.

One method of accelerating the schedule is to add activities to the **critical path** that are empty or that are optional. If the project is behind schedule, the time can be made up by dropping these activities. This extra time that is built into the schedule is called ***contingency time***, buffer, or reserve time.

Activities that are not on the **critical path** that have **free float** can be delayed without delaying the end date of the project if they start by the late start date. Project managers can divert some resources from activities with **free float** to activities on the **critical path** without delaying the completion of the project.

Changing Scope

The unit cost of work to be performed on a project is calculated at the beginning of the project based on the execution strategy of the project to meet the project completion date. If the project completion date is moved up, then the unit cost of work will likely increase. Conversely, a project team may be able to save money by extending the project end date. With more time, the project team may be able to schedule activities in such a way to reduce their costs. For example, an activity requiring overtime to be paid can now pay the labour at normal rates, saving the overtime premium. Changing elements of the master schedule means a change in scope. Scope changes often affect costs and require agreement by the parties who signed the original scope documents.

Additional Resources

Another option is to allocate funds that can be used to add resources if necessary. Available resources can be increased by adding overtime to existing **resource calendars** or by hiring additional contract workers or renting additional equipment.

Adding Resources to the Dreamliner Project

When Boeing sales of the new 878 Dreamliner Airplane exceeded expectations, contractors who were building the plane were asked to increase production while maintaining all quality and safety requirements. All contractors involved in the plane production were affected by this change.

One project team was responsible for developing and delivering training to the new employees who would be building the fuselage of the Dreamliner. Training for new employees had to be complete three months early and the project team developed an execution strategy to meet the new deadlines. The project had a month of float, so the project accelerated the schedule by two months. The team authorized overtime from forty to fifty hours a week for team members working activities on the **critical path**. The project team leased additional space and hired contractors to perform selected work packages on the **critical path** and delayed the production of library quality documents until after the critical dates on the project. Authorizing overtime and hiring contractors added a 15% cost to the project. Overtime and the procurement of additional contract help was authorized only for work packages on the **critical path** because work not on the **critical path** would not accelerate the schedule.

Changing Quality

Another option for accelerating the schedule is the changing of the quality specifications of the product. This is usually done as a scope change.

Making Up Time by Reducing Quality

A western university contracted an online learning company to make an online independent study course for their Calculus 112 class. As the project went on it fell behind schedule. To speed up the project, it was decided to produce fewer animated videos, which meant that some of the lessons would not have these learning aids. The contract did not specify the amount or quality of these videos so this change did not require a change of scope. As a result, some of the more difficult calculus principles had only text as instruction. The university did not realize this change had been made until after the project was completed and being used by the students.

KEY TAKEAWAYS

- Progress can be measured by determining the percentage of resources expended, completion of activities by scheduled dates, **milestones** achieved, or fraction of activities accomplished. Standards used to measure progress, particularly when partial payment to contractors is concerned, should be specified in contract documents.
- **Resource levelling** is reallocating people and equipment to remove periods of overuse or under use.
- Unplanned delays and costs can be anticipated by including **contingency time** and budget amounts where needed to keep the schedule on time. Resource allocation and **resource calendars** should be examined to determine if a resource is over committed. Free float can be used to delay noncritical activities that use the same resource to allocate its time more evenly. If it is necessary to accelerate the schedule, activities that are not on the **critical path** can be delayed using their **free float** and their resources can be moved to activities on the **critical path** to complete them sooner. Contingency resources can be committed to speeding up the activities. If necessary, the scope can be changed to bring in additional resources or lower the quality.

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[1] Robert X. Cringely, Triumph of the Nerds, June 1996, http://www.pbs.org/nerds/part2.html (accessed July 27, 2009).

8.5 Project Scheduling Software

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the relationship between the choice of software and project complexity.
2. Identify the features that should be considered when selecting software for project management.

Low-complexity projects can be managed with lists of activities on paper or by using an outline in word processing or spreadsheet software. This software is inadequate for tracking complex projects. Fortunately, there are several dedicated software programs that keep track of the complex relationships between activities and resources.

Appropriate to Project Complexity

Simple projects can be tracked using general purpose word processing and spreadsheet software like those available in Microsoft Office or OpenOffice. Medium-complexity projects benefit from dedicated project management software such as Microsoft Project and OpenProject. Complex projects require software that can track the interactions of thousands of tasks and produce sophisticated reports such as Oracle's P6.

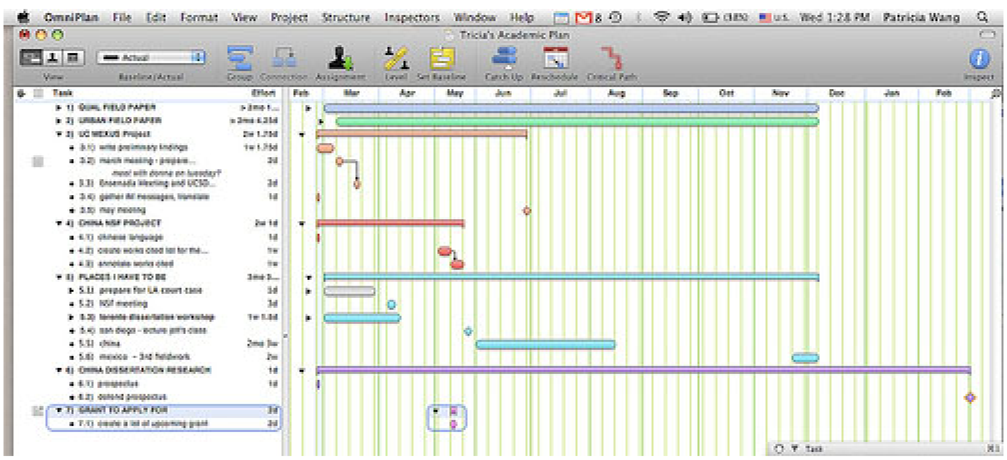


Image by Tricia Wang 王圣捷

Features

There are many features to consider when selecting the appropriate software. One consideration is cost. There are dozens of computer software programs available with a wide range of prices; some open source software programs are free, but others cost up to a thousand dollars. However, cost is not the most important feature.

Another factor to consider is familiarity. Use software that is already in use and with which most team members are already familiar. If software that is used by most team members is appropriate to the complexity of your project, it is the default choice. It is also valuable to know what software is used by key **vendors** or project partners so files can be exchanged electronically in the same format.

Team members should be able to view the project schedule. Some software products require the use of expensive proprietary software that runs on the company's server and that will allow several different team members to use the same schedule and restricts the use of the software to team members who have access to the company's computer system. Other software products use a server on the Internet that is open to team members and **vendors** who have valid passwords.

Any project management software that is selected must have the ability to track and display basic features such as the following:

- Durations
- Relationships
- **Milestones**
- Start and end dates
- **Resource calendars**
- Graphic displays using **Gantt** and network charts

For more complex projects, look for advanced features, such as the following:

- Issue tracking that tracks problems, actions, and resolutions
- Project portfolio management that tracks and compares groups of related projects
- Automatic **resource levelling** and alerts when a resource is over scheduled
- Document management feature that tracks contracts, bids, scope changes, and incidents

KEY TAKEAWAYS

- Medium- to high-complexity projects usually require the use of software that is designed specifically for managing projects.
- Features to look for when choosing project management software include (1) compatibility with existing software at the company or its **vendors**, (2) basic features for managing medium-complexity projects, (3) a method for collaboration between team members, and (4) if needed, advanced features for managing multiple projects.

CHAPTER 9

9 Costs and Procurement

9.0 Overview

Visit Audio Recordings for the audio version of this section.

The cost portion of the chapter aligns with chapter 7 of the PMBOK and 9% of the CAPM questions come from this knowledge area. The content connects to the Planning and Monitoring & Controlling category of the PMP questions. The **procurement** portion of the chapter deals with Chapter 12 of the PMBOK and 9% of the CAPM questions come from this knowledge area. The content connects to the Planning, Executing, Monitoring & Controlling and closure category of the PMP questions.

An important part of a project manager's job is managing money. All types of organizations must manage their money well in order to fulfill their mission, including not-for-profit and government organizations. The tools and methods used to manage money on a project vary depending on the phase and complexity of the project. This chapter first describes the methods used to estimate the cost of a project, create a budget, and manage the cost of activities while the project is being executed. It then covers a major component of cost management—the **procurement** process.

To achieve the objectives of the project, the management team often needs to look outside the internal organization for additional help. The process of obtaining goods and services from providers who are outside of the organization is called ***procurement***. We will discuss ways of selecting the work that will be procured and the different methods and processes for procuring the equipment, materials, and services for the project.

The **procurement** effort on projects varies widely and depends on the type of project. Often the client organization will provide **procurement** services on less complex projects. In this case, the project team identifies the materials, equipment, and supplies needed by the project and provides product specifications and a detailed delivery schedule. When the procurement department of the parent organization provides **procurement** services, a liaison from the project can help the procurement team better understand the unique requirements of the project and the time-sensitive or critical items of the project schedule.

On larger, more complex projects, personnel are dedicated to procuring and managing the equipment, supplies, and materials needed by the project. Because of the temporary nature of projects, equipment, supplies, and materials are procured as part of the product of the project or for the execution of the project. For example, workbook materials might be procured for the product of the project, and the computers and software might be equipment procured for the execution of the project work. At the end of the project, equipment bought or rented for the execution of the work of the project are sold, returned to rental organizations, or disposed of some other way.

More complex projects will typically procure through different **procurement** and management methods. ***Commodities*** are common products that are purchased based on the lowest bid. Commodities include items like concrete for building projects, office supplies, or even lab equipment for a research project. The second type of **procurement** includes products that are specified for the project. ***Vendors*** who can produce these products bid for a contract. The awarding of a contract can include price, ability to meet the project schedule, the fit for purpose of the product, and other considerations important to the project. Equipment especially designed and built for a research project is an example of what might be provided by a project vendor. These **vendors**' performances become important parts of the project, and the project manager assigns resources to coordinate the work and schedule of the vendor.

The third **procurement** approach is the development of one or more partners. A public relations firm that is awarded the advertising contract for a major project and a research firm that is conducting critical subparts of the research are examples of potential project partners. A partner contributes to and is integrated into the execution plan. Partners perform best when they share the project vision of success and are emotionally invested in the project. The project management team builds and implements a project procurement plan that recognizes the most efficient and effective **procurement** approach to support the project.

Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=160

(Autonomy) That depends on the amount of control, or the amount of influence that I have over a budget and defining that budget varies on the project. When we work for external clients, they often want a fairly detailed prescription of what we intend to do and what it will cost. We do that by breaking down tasks. We usually have a pretty good idea of the various specific tasks that you're going to have to carry out in order to complete a budget or to complete a project. Click here to access entire transcript

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

Well project budgets are scary. Because when you are out of money, you are out of money. Your **goal** is to come in under budget if you possibly can. You know it's funny, there is a concept, I was working on this project, training submarine finding helicopter pilots and sensor operators so we had two little mini-projects going on. Well they weren't mini-projects they were pretty good-sized projects. We had a staff of about 25 people. We had to pay them all. We had to bring them on at the right time, and we had to put them off of the project at the right time. Because if we didn't then, they would bill against the project and we would use up funds that we didn't have. So we had to know when a certain set of jobs was going to be done. One of our artists was a cartoonist. We had to know when he came on the project and when he left the project. We had to make sure he was busy the whole time. So sometimes that comes into conflict with the production schedule, and you end up having people being paid longer than you expected. Boy, budget. There is a concept called designed costs. I think it's an important concept for instructional designers to understand. It means you only have a certain amount of time, and a certain amount of money to pay people, and so you make your design to fit those resources. There is no project that you get on where you couldn't design something that is like the Taj Mahal, ornate and gilded and beautiful and pure marble and all that kind of stuff. But you know, every project can't be the Taj Mahal. You can't afford it, it takes too long, too many people. And so you have to make your design fit what you have. And people say that's giving up your principles, isn't there something wrong about that, isn't there something unethical about that. And the answer is no. When your client contracts with you for a certain amount of money, that's what they want to pay you. And you can go back to your client with a change order, and that's kind of an official thing, a change order, saying, now if you want this extra feature this is how much it's going to cost you. Because one of the things that happens as you design for a client, all of a sudden they start getting the picture, you create these wonderful clouds of vision in their mind and they say, "That's so cool! We could do this. And we could do this…" You excite them. And they start imagining, "Wow we could create this, such a cool thing". Well your budget said Volkswagen, it didn't say Cadillac. It said Volkswagen. So if you want a Cadillac we're going to have to re-write some of the contract to say Cadillac in it. So budgets are scary.

Heather Bryce – Independent Studies – BYU

Well, we didn't manage our budget very well for this course. Because of the meetings, the excessive meetings, it, the cost jumped up dramatically. And a lot of the things that we made decisions on, the instructional designer. You know, Flash takes a long time, video takes a long time, the recording, the post process, the pre-process. Those are costly things. So you have to kind of weigh those things out when you create a course. But, with an art course it would not be a very good course, instructionally, if you didn't have any of those things in it, if it was just straight reading. In the end, we spent a lot more money than we planned, but it made for such a rich course. It's a fantastic drawing course. In the triangle of project management, when you manage your time and your cost and your quality, the quality of this course is incredible. The time, we kept our time on time. What we gave up was, we gave up cost for quality in this example. And the award that we received, we all feel like it was worth it, but of course we wouldn't be in business if we did that with every course. So you have to weigh it out. What we have to manage the course budget, is we do have a program. Our same program that we use to manage our tasks, and everyone records their hours that they spend on each task. And so it tabulates how much money we're spending on the budget so you can look at the course at any time. I just, what I do is, and the instructional designers we check on that throughout. So each phase of the project it will tell you how much money. And so, how it's supposed to work is when you see that you are close, it will kind of go red, and it will show you that you're using up your budget money for that processor, so you better hurry it out. So, how ideally it works is you cut things out if you have to stay within your budget, but like I said, that was probably a project failure as far as budget went for this course.

Dr. Larry Seawright – Center for Teaching and Learning – BYU

So in building the BYU Learning Suite, we're at the Center for Teaching and Learning. So, our budget is pretty constrained. And we have lots of stuff that we're doing. So we were kind of given this much money to do things, and we said we can only do this much of the project and you want this much done. So they said okay, we'll give you this much. And we just had to keep going back, this much, this much, this much. So, you know, budget management is one of the critical things that any project manager has to do. Where you're a smaller entity within a larger organization, and the larger organization is the one asking you to do something at least you're in a good position. You can go back and ask for more money. Is this really important to you? Then give us some more money. Is this really important to you? Then give us some more money. And that's kind of how we've been having to do this. They shortened the time frame that we needed to do the project in by quite a bit. So that compressed the development cycle. The budget went from this to this. Simply because we had to hire a lot more people to get it done that fast. So you know, it's a difficult project management triangle. You know, it's time, scope and money. If they reduce the time, you've got to spend more money, or reduce the scope. And we actually had to do both. We couldn't get as much done in that amount of time. But we tried to get more done by hiring more people. So you know, it's the old trade off.

9.1 Estimating Costs

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe methods of estimating costs.
2. Identify the effects of project phase and complexity on the choice of estimating method.
3. Describe the method of combining cost estimates with a schedule to create a budget.

ESTIMATING COSTS TO COMPARE AND SELECT PROJECTS

During the conceptual phase when project selection occurs, economic factors are an important consideration when 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 from previous projects that can be adjusted—***scaled***—to match the size and complexity of the current project or by applying standardized formulas.

Image by rupixen

Analogous Estimate

An estimate that is based on other project estimates is an ***analogous estimate***. If a similar project cost 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 difference. The selection of projects that are similar and the amount of adjustment needed is up to the judgment of 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.

Analogous Estimate for John's Move

In the John's move example, 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 fourteen-foot truck. It cost 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 and he decided that the cost would be affordable and the project could go forward.

Less experienced managers who are required to make **analogous estimates** can look through the documentation that is available from previous projects. As explained in Chapter 2, if those projects were evaluated using the **Darnall-Preston Complexity Index (DPCI)**, the manager can quickly identify projects that have similar profiles to the project under consideration even if those projects were managed by other people. 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 which the manager can use to justify the estimate.

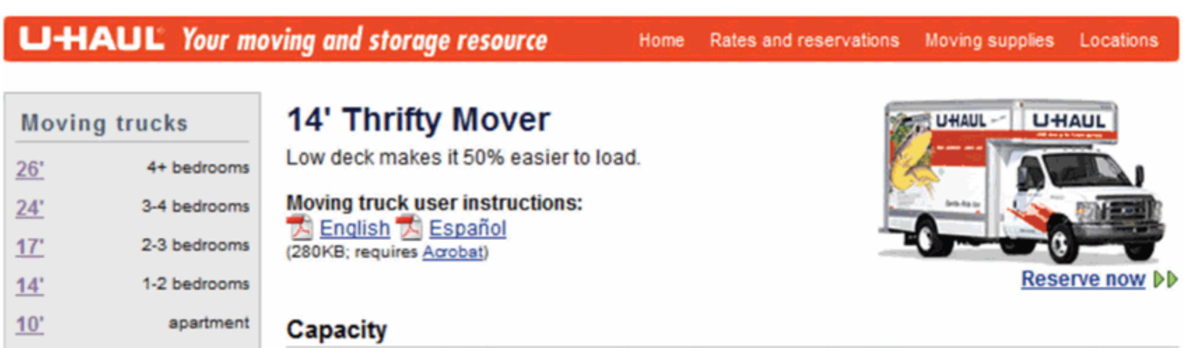
Parametric Estimate

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, they 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 labor costs. Other **parameters** such as **quality** of finishes are used to further refine the estimate. Estimates that are calculated by multiplying measured **parameters** by cost-per-unit values are ***parametric estimates***.

Parametric Estimate for John's Move

To estimate the size of the truck needed for John's move, the parameter used by a truck rental company is the number of bedrooms, as shown in Figure 9.1.

Figure 9.1 Number of Bedrooms Used for Parametric Cost Estimate



The moving company assumes that the number of bedrooms is the important parameter in determining how big a truck is needed for a move. For John's move, he has a one-bedroom apartment, so he chooses the fourteen-foot truck. Once the size is determined, other **parameters**, such as distance and days, are used to estimate the cost of the truck rental.

ESTIMATING COSTS TO INITIATE PROJECTS

Once the project is selected, more accurate estimates are often needed to raise funds and agree on contracts with **vendors** in the **initiation phase**.

Estimate During the Initiation Phase of John's Move

John recalled that his friend also told him how tiring it was to do all the packing, loading, and driving himself, and some items were damaged when the load shifted inside the truck during the trip. John decides to call in favours from two friends, Dion and Carlita, to help him pack in Montreal and to hire some of the skilled labour like that needed to load the truck properly.

Vendor Bid Analysis

If services or products will be provided by **vendors**, the cost of those services can be determined by issuing a ***request for proposal (RFP)***. The RFP describes the work, service, or product to be provided by the vendor and the **quality** level required. The RFP is sent to a list of **vendors** who are ***qualified***—meet standards of reliability and capability—to perform this type of work. They respond with a proposal for completing the work described in the RFP, including an estimate of the cost. Some government organizations are required to use the qualified vendor with the lowest bid. Other organizations are not bound to take the lowest bid but are usually required to justify their reasons for not doing so.

Using RFPs to Make Estimates on John's Move

John wants to find out how much it would cost to hire a skilled crew to load and secure the furniture in the truck and then have another crew from the same company meet him in Atlanta to unload the truck and help him unpack. He is not sure if any companies offer this option, so he decides to ask three moving companies for bids. He also decides to ask for bids on a standard move that includes all phases of packing, loading, transportation, and unloading as a comparison to see if his cost-saving plan is worth the extra effort.

The project management team can review the responses by several **vendors** to the RFP to determine if their estimate of the cost of that aspect of the project is close to the estimate made during the project selection stage. If the estimates by the **vendors** are much higher than expected, and if the project cannot be completed for the cost that was used to select the project, the selection decision might have to be reconsidered. Reconsidering the selection of the project should take into consideration the economic ratings of the competing projects that were not chosen and who the project champions are for the projects that would be affected.

Some **vendors** may suggest an alternative way to meet the objective of the RFP in a more cost-effective manner that does not match the specifics of the RFP. Such alternatives can reduce costs if they are acceptable.

Bottom-Up Estimating

The most accurate and time-consuming estimating method is to identify the cost of each item in each activity of the schedule, including labour and materials. If you view the project schedule as a hierarchy where the general descriptions of tasks are at the top and the lower levels become more detailed, finding the price of each item at the lowest level and then summing them to determine the cost of higher levels is called ***bottom-up estimating***.

Bottom-Up Estimate for John's Move

After evaluating the bids by the moving companies, John decides the savings are worth his time if he can get the packing done with the help of his friends. He decides to prepare a **detailed estimate** of costs for packing materials and use of a rental truck. He looks up the prices for packing materials and truck rental costs on company Web sites and prepares a detailed list of items, quantities, and costs, as shown in Figure 9.2.

Figure 9.2 Detailed Cost Estimate

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

This type of estimate is typically more accurate than an analogous or parametric estimate. In this example, the sum of packing materials and truck expenses is estimated to be $661.25.

The detail can be *rolled up*—subtotalling—to display less detail. This process is made easier using computer software. On projects with low complexity, the cost estimates can be done on spreadsheet software. On larger projects, software that manages schedules can also manage costs and display costs by activity and by category. For example, the subtotal feature could be used in Excel and collapsed to show the subtotals for the two categories of costs, as shown in Figure 9.3.

Figure 9.3 Sum of Detailed Costs by Type

	A	B	C	D	E
1	Type	Description	Quantity	Unit Price	Cost
13	**Packing Materials Total**				$216.65
16	**Truck Total**				$445.00
17	**Grand Total**				$661.65
18					

Activity-Based Estimates

An activity can have costs from multiple **vendors** in addition to internal costs for labour and materials. Detailed estimates from all sources can be reorganized so those costs that are associated with a particular activity can be grouped by adding the activity code to the **detailed estimate**, as shown in Figure 9.4.

Figure 9.4 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
Truck	Rental	2.2			$400.00
Truck	Gas at 10mpg	2.2	200	$2.25	$45.00

Category	Activity	Cost
Packing Materials	2.1	$216.65
Truck	2.2	$445.00

The detailed cost estimates can be sorted by activity and then subtotalled by activity to determine the cost for each activity.

Establishing a Budget

Once you have broken your project down into activities, you will be able to calculate your overall project costs by estimating and totalling the individual activity costs.

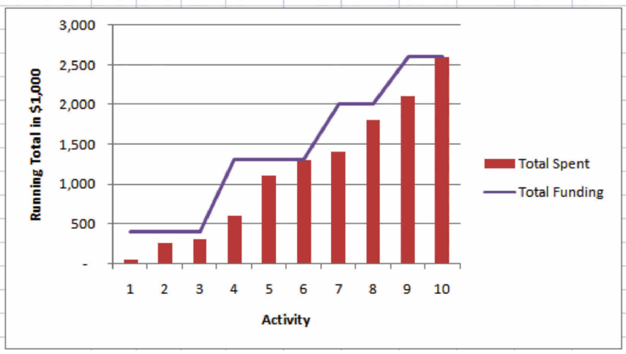
This process of subtotaling costs by category or activity is called ***cost aggregation***.

Budget Timeline

Costs are associated with activities and since each activity has a start date and a **duration** period, it is possible to calculate how much money will be spent by any particular date during the project. The money needed to pay for a project is usually transferred to the project account shortly before it is needed. These transfers must be timed so that the money is there to pay for each activity without causing a delay in the start of the activity. If the money is transferred too far in advance, the organization will lose the opportunity to use the money somewhere else, or they will have to pay unnecessary **interest** charges if the money is borrowed. A schedule of money transfers is created that should match the need to pay for the activities. The process of matching the schedule of transfers with the schedule of activity payments is called ***reconciliation***. Refer to Figure 9.5 which shows the costs of ten major activities in a project. Funds are transferred into the project account four times. Notice that during most of the project, there were more funds available than were spent except at activity 6 when all the available funds were spent.

Figure 9.5 Fund Transfers and Expenditures

Activity	1	2	3	4	5	6	7	8	9	10
Cost	50	200	50	300	500	200	100	400	300	500
Total Spent	50	250	300	600	1,100	1,300	1,400	1,800	2,100	2,600
Transfers	400			900			700		600	
Total Funding	400	400	400	1,300	1,300	1,300	2,000	2,000	2,600	2,600
Cash in Account	350	150	100	700	200	-	600	200	500	-



In the project budget profile shown in Figure 9.5 there is no margin for error if the total of the first six activities exceeds the amount of funding at that point in the project.

Contractual agreements with **vendors** often require partial payment of their costs during the project. Those contracts can be managed more conveniently if the unit of measure for partial completion is the same as that used for cost budgeting. For example, if a graphic designer is putting together several pieces of artwork for a textbook, their contract may call for partial payment after 25% of their total number of drawings is complete.

KEY TAKEAWAYS

- Analogous estimating scales an estimate from a similar project to match the current project. Parametric estimating multiplies a standard cost-per-unit value by the number of units in the project. Bids from contractors can be compared to estimate costs. **Bottom-up estimating** determines the cost of each detail and aggregates them to determine activity cost estimates.
- During the project selection and approval stage, rough estimates are used that are usually obtained using analogous and parametric methods. Vendor bid analysis and detailed bottom-up estimates are used in the **initiation phase** to estimate project costs.
- Detailed estimates are associated with activities and aggregated during the **planning phase** to create an activity-based budget. Funding transfers are arranged to reconcile money spent to money from funding sources in a timely manner.

9.2 Managing the Budget

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LEARNING OBJECTIVES

1. Describe methods to manage **cash flow**.
2. Describe the terms and relationships of budget factors used in earned value analysis.
3. Calculate and interpret budget and schedule **variances**.
4. Calculate and interpret the **schedule performance index** and the **cost performance index**.
5. Calculate and interpret estimates to complete the project.
6. Calculate the revised final 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 to manage those variations.

MANAGING CASH FLOW

If the total amount spent on a project is equal to or less than the amount budgeted, the project can still be in trouble if the funding for the project is not available when it is needed. There is a natural tension between the financial people in an organization, who do not want to pay for the use of money that is just sitting in a checking account, and the project manager, who wants to be sure that there is enough money available to pay for project expenses. The financial people prefer to keep the company's money working in other investments until the last moment before transferring it to the project account. The contractors and **vendors** have similar concerns, and they want to get paid as soon as possible so they can put the money to work in their own organizations. The project manager would like to have as much cash available as possible to use if activities exceed budget expectations.


Image by kenteegardin

Contingency Reserves

Most projects have something unexpected occur that increases costs above the original estimates. If estimates are rarely exceeded, the estimating method should be reviewed because the estimates are too high. It is impossible to predict which activities will cost more than expected, but it is reasonable to assume that some of them will. Estimating the likelihood of such events is part of risk analysis, which is discussed in more detail in a later chapter.

Instead of overestimating each cost, money is budgeted for dealing with unplanned but statistically predictable cost increases. Funds allocated for this purpose are called ***contingency reserves.***[1] Because it is likely that this money will be spent, it is part of the total budget for the project. If this fund is adequate to meet the unplanned expenses, then the project will complete within the budget.

Management Reserves

If something occurs during the project that requires a change in the project scope, money may be needed to deal with the situation before a change in scope can be negotiated with the **project sponsor** or client. It could be an opportunity as well as a challenge. For example, if a new technology were invented that would greatly enhance your completed project, there would be additional cost and a change to the scope, but it would be worth it. Money can be made available at the manager's discretion to meet needs that would change the scope of the project. These funds are called ***management reserves***. Unlike **contingency reserves**, they are not likely to be spent and are not part of the project's budget baseline, but they can be included in the total project budget.[2]

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 the John's move example, he estimated that the move would cost about $1,500 and take about sixteen 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 points 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 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.

EARNED VALUE ANALYSIS

A method that is widely used for medium- and high-complexity projects is the ***earned value management (EVM)*** method. EVM is a method of periodically comparing the budgeted costs with the **actual costs** during the project. It combines the scheduled activities with detailed cost estimates of each activity. It allows for partial completion of an activity if some of the detailed costs associated with the activity have been paid but others have not.

The ***budgeted cost of work scheduled (BCWS)*** comprises the detailed cost estimates for each activity in the project. The amount of work that should have been done by a particular date is the ***planned value (PV)***. These terms are used interchangeably by some sources, but the planned value term is used in formulas to refer to the sum of the budgeted cost of work up to a particular point in the project, so we will make that distinction in the definitions in this text for clarity.

Planned Value on Day Six of John's Move

On day six of the project, John should have taken his friends to lunch and purchased the packing materials. The portion of the BCWS that should have been done by that date (the planned value) is listed in Figure 9.6. This is the planned value for day six of the project.

Figure 9.6 Planned Value for Lunch and Packing Materials

Description	Quantity	Cost
Lunch	3	$45.00
Small Boxes	10	$17.00
Medium Boxes	15	$35.25
Large Boxes	7	$21.00
Extra Large Boxes	7	$26.25
Short Hanger Boxes	3	$23.85
Box Tape	2	$7.70
Markers	2	$3.00
Mattress/Spring Bags	2	$5.90
Lift Straps per Pair	1	$24.95
Bubble Wrap	1	$19.95
Furniture Pads	4	$31.80
	Total	**$261.65**

The ***budgeted cost of work performed (BCWP)*** is the budgeted cost of work scheduled that has been done. If you sum the BCWP values up to that point in the project schedule, you have the ***earned value (EV)***. The amount spent on an item is often more or less than the estimated amount that was budgeted for that item. The ***actual cost (AC)*** is the sum of the amounts actually spent on the items.

Comparing PV, EV, and AC in John's Move on Day Six

Dion and Carlita were both trying to lose weight and just wanted a nice salad. Consequently, the lunch cost less than expected. John makes a stop at a store that sells moving supplies at discount rates. They do not have all the items he needs, but the prices are lower than those quoted by the moving company. They have a very good price on lifting straps so he decides to buy an extra pair. He returns with some of the items on his list, but this phase of the job is not complete by the end of day six. John bought half of the small boxes, all of five other items, twice as many lifting straps, and none of four other items. John is only six days into his project, and his costs and performance are starting to vary from the plan. Earned value analysis gives us a method for reporting that progress (refer to Figure 9.7).

Figure 9.7 Planned Value, Earned Value, and **Actual Cost**

	Project Earned Value Analysis—Day 6					
	Budgeted Cost of Work Scheduled (BCWS)		Budgeted Cost of Work Performed (BCWP)		Actual Cost (AC)	
Description	**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
Lunch	3	$45.00	3	$45.00	3	$35.00
Small Boxes	10	$7.00	5	$8.50	5	$9.50
Medium Boxes	15	$35.25	15	$35.25	15	$28.00
Large Boxes	7	$21.00				
Extra Large Boxes	7	$26.25				
Short Hanger Boxes	3	$23.85				
Box Tape	2	$7.70	2	$7.70	2	$5.50
Markers	2	$3.00	2	$3.00	2	$2.00
Mattress/Spring Bags	2	$5.90	2	$5.90	2	$7.50
Lift Straps per Pair	1	$24.95	1	$24.95	2	$38.50
Bubble Wrap	1	$19.95				
Furniture Pads	4	$31.80	4	$31.80	4	$28.50
	PV	**$261.65**	**EV**	**$162.10**	**AC**	**$154.50**

The original schedule called for spending $261.65 (PV) by day six. The amount of work done was worth $162.10 (EV) according to the estimates, but the actual cost was only $154.50 (AC).

SCHEDULE ***VARIANCE***

The project manager must know if the project is on schedule and within the budget. The difference between planned and actual progress is the ***variance***. The ***schedule variance (SV)*** is the difference between the earned value (EV) and the planned value (PV). Expressed as a formula, SV = EV − PV. If less value has been earned than was planned, the schedule variance is negative, which means the project is behind schedule.

Schedule Variance on John's Move

Planning for John's move calls for spending $261.65 by day six, which is the planned value (PV). The difference between the planned value and the earned value is the scheduled variance (SV). The formula is SV = EV − PV. In this example, SV = $162.10 − $261.65 = $(99.55) A negative SV indicates the project is behind schedule.

The difference between the **earned value (EV)** and the **actual cost (AC)** is the ***cost variance (CV)***. Expressed as a formula, CV = EV – AC. A positive CV indicates the project is under budget.

Cost Variance on John's Move

The difference between the earned value of $162.10 and the **actual cost** of $154.50 is the cost variance (CV). The formula is CV = EV − AC. In this example, CV = $162.10 − $154.50 = $7.60.

Variance Indexes for Schedule and Cost

The schedule variance and the cost variance provide the amount by which the spending is behind (or ahead of) schedule and the amount by which a project is exceeding (or less than) its budget. They do not give an idea of how these amounts compare with the total budget.

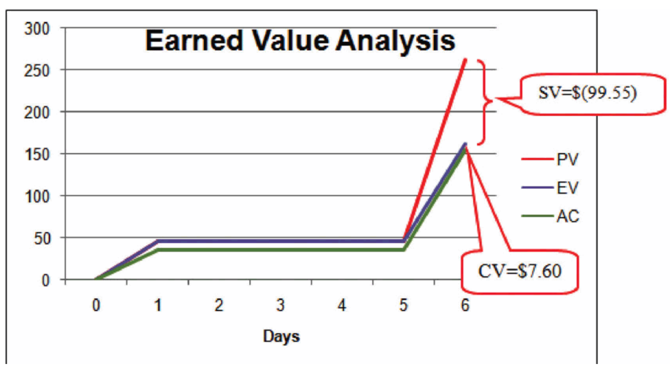
The ratio of earned value to planned value gives an indication of how much of the project is completed. This ratio is the ***schedule performance index (SPI)***. The formula is SPI = EV/PV. In the John's move example, the SPI equals 0.62 (SPI = $162.10/$261.65 = 0.62) A SPI value less than one indicates the project is behind schedule.

The ratio of the earned value to the **actual cost** is the ***cost performance index (CPI)***. The formula is CPI = EV/AC.

Cost Performance Index of John's Move

In the John's move example, CPI = $162.10/$154.50 = 1.05 A value greater than 1 indicates the project is under budget.

Figure 9.8 Schedule Variance and Cost Variance on Day Six of the John's Move Project



The cost variance of positive $7.60 and the CPI value of 1.05 tell John that he is getting more value for his money than planned for the tasks scheduled by day six. The schedule variance (SV) of negative $99.55 and the **schedule performance index (SPI)** of 0.62 tell him that he is behind schedule in adding value to the project.

During the project, the manager can evaluate the schedule using the schedule variance (SV) and the **schedule performance index (SPI)** and the budget using the cost variance (CV) and the cost performance index (CPI).

ESTIMATED COST TO COMPLETE THE PROJECT

Partway through the project, the manager evaluates the accuracy of the cost estimates for the activities that have taken place and uses that experience to predict how much money it will take to complete the unfinished activities of the project—the***estimate to complete (ETC)***.

To calculate the ETC, the manager must decide if the cost variance observed in the estimates to that point are representative of the future. For example, if unusually bad weather causes increased cost during the first part of the project, it is not likely to have the same effect on the rest of the project. If the manager decides that the cost variance up to this point in the project is atypical—not typical—then the **estimate** to complete is the difference between the original budget for the entire project—the ***budget at completion (BAC)***—and the **earned value (EV)** up to that point. Expressed as a formula, ETC = BAC − EV

Estimate to Complete John's Move

In John's move, John was able to buy most of the items at a discount house that did not have a complete inventory and, he chose to buy an extra pair of lift straps. He knows that the planned values for packing materials were obtained from the price list at the moving company where he will have to buy the rest of the items, so those two factors are not likely to be typical of the remaining purchases. The reduced cost of lunch is unrelated to the future costs of packing materials, truck rentals, and hotel fees. John decides that the factors that caused the **variances** are atypical. He calculates that the **estimate to complete (ETC)** is the **budget at completion** ($1,534) minus the earned value at that point ($162.10), which equals $1,371.90. Expressed as a formula, ETC = $1,534 − $162.10 = $1,371.90.

If the manager decides that the cost variance is caused by factors that will affect the remaining activities, such as higher labour and material costs, then the **estimate to complete (ETC)** needs to be adjusted by dividing it by the cost performance index (CPI). For example, if labour costs on the first part of a project are estimated at $80,000 (EV) and they actually cost $85,000 (AC), the cost variance will be 0.94. (Recall that the cost variance = EV/AC).
To calculate the **estimate to complete (ETC)** assuming the cost variance on known activities is typical of future cost, the formula is ETC = (BAC – EV)/CPI. If the **budget at completion (BAC)** of the project is $800,000, the estimate to complete is ($800,000 – $80,000)/0.94 = $766,000.

ESTIMATE FINAL PROJECT COST

If the costs of the activities up to the present vary from the original estimates, it will affect the total **estimate** for the project cost. The new **estimate** of the project cost is the **estimate** at completion (EAC). To calculate the EAC, the ***estimate to complete (ETC)*** is added to the **actual cost (AC)** of the activities already performed. Expressed as a formula, EAC = AC + ETC.

Estimate at Completion for John's Move

The revised estimate at completion (EAC) for John's move at this point in the process is EAC = $154.50 + $1,371.90 = $1,526.40.

Refer to Figure 9.9 for a summary of terms and formulas.

Figure 9.9 Summary of Terms and Formulas for Earned Value Analysis

Term	Acronym	Description	Formula	John's Move
Actual Cost	AC	The money actually spent on projects up to the present		$154.50
Budget at Completion	BAC	Original budget for the project (same as BCWS)		$1,534.00
Cost Performance Index	CPI	Ratio of earned value to actual cost	CPI = EV / AC	1.05
Cost Variance	CV	Difference between earned value and actual cost	CV = EV – AC	$ 7.60
Earned Value	EV	Sum of estimates for work actually done up to the present		$162.10
Estimate at Completion	EAC	Revised estimate of total project cost	EAC = AC + ETC	$1,526.40
Estimate to Complete	ETC	Money to complete the project if early cost variance is atypical	ETC = BAC – EV	$1,371.90
Estimate to Complete	ETC	Money to complete the project if early cost variance is typical	ETC = (BAC – EV) / CPI	N/A
Planned Value	PV	Sum of the estimates for work done up to the present		$261.65
Schedule Performance Index	SPI	Ratio of earned value to planned value	SPI = EV / PV	.62
Schedule Variance	SV	Difference between earned value and planned value	SV = EV – PV	$(99.55)

KEY TAKEAWAYS

- Extra money is allocated in a contingency fund to deal with activities where costs exceed estimates. Funds are allocated in a management reserves in case a significant opportunity or challenge occurs that requires change of scope but funds are needed immediately before a scope change can typically be negotiated.
- Schedule variance is the difference between the part of the budget that has been done so far (EV) versus the part that was planned to be completed by now (PV). Similarly, the cost variance is the difference between the EV and the **actual cost (AC)**.
- The **schedule performance index (SPI)** is the ratio of the earned value and the planned value. The cost performance index (CPI) is the ratio of the **earned value (EV)** to the **actual cost (AC)**.
- The formula used to calculate the amount of money needed to complete the project (ETC) depends on whether or not the cost variance to this point is expected to continue (typical) or not (atypical). If the cost variance is atypical, the ETC is simply the original total budget (BAC) minus the **earned value (EV)**. If they are typical of future cost variances, the ETC is adjusted by dividing the difference between BAC and EV by the CPI.
- The final budget is the **actual cost (AC)** to this point plus the **estimate to complete (ETC)**.

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[1] Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008), 173.

[2] Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008), 177.

9.3 Identifying the Need for Procuring Services

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LEARNING OBJECTIVES

1. Identify what factors are considered when deciding to outsource or perform the work within the organization.

The decision to procure work from outside companies (***outsourcing***) or whether to have the project team members perform the work (***self-performed***) is decided by the project team. Luu, Ng, and Chen[1] studied project procurement selection priorities and identified budget and schedule as the most important considerations in the decision to outsource activities. Other factors that must be considered are risk, **quality**, and flexibility. Self-performing and outsourcing the work have both benefits and risks. The project procurement strategy begins with these self-perform or outsourcing evaluations.

Outsourcing Decision

A design company has a contract to build a large training curriculum for a company in downtown New York. Most, if not all, of the editing and graphic-art work will be contracted with companies that specialize in these areas. Existing companies that have expertise can provide these project needs faster and at a much lower cost than if the project manager's organization attempted to build the capacity itself.Some outsourcing decisions—sometimes called make or buy decisions—are difficult. In the same training project example above, new learning devices and methods are required that will make the instruction more efficient. The project manager can decide to outsource this portion of the project to companies that have technological expertise or develop this expertise on the project and self-perform the work. The costs of developing this expertise within the project will be more expensive and may take more time than outsourcing this work.

Image by Astemir Almov

Self-performing this work also has benefits. The project team would develop this expertise and the additional expertise would add value to their parent company and save money on future projects. The project management team would have greater control over the work because the work would be performed by members of the project team instead of outsiders.

Outsourcing Versus Self-Performing

On the New York project, the project manager decided to outsource the portion of the work that required new methods and materials. The project team designers evaluated the work during the project and assessed the appropriate methods and costs for the parent company to develop this capacity within the company. The additional costs of developing the capacity and the additional risks of implementing a new method with existing resources outweighed the benefits of developing the capacity within the organization.The basic instructional design activities are the core expertise of the parent company and the project team had access to the qualified resources to perform the work. The decision to self-perform this portion of the work was easy because the company had a cost and schedule advantage by using the existing resources.

KEY TAKEAWAYS

- The factors that influence procurement are primarily cost and schedule but also include risk, **quality**, and flexibility.
- To determine whether to outsource or do the work within the organization, consider which option is less costly and which option can deliver the work on time.

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[1] Duc Thanh Luu, S. Thomas Ng, and Swee Eng Chen, "Parameters Governing the Selection of Procurement System," Journal of Engineering, Construction, and Architectural Management10, no. 3.

9.4 Procurement of Goods

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the role of **suppliers**.
2. Describe the role of **vendors**.
3. Describe the role of partners.

After the outsourcing versus self-performing decisions are made, the procurement team develops the purchasing plan.

The method of purchasing products or services depends on the uniqueness and importance of the product or service. One way to organize the procurement plan is by the type of relationship with the providers of the outsourced goods or services.

Suppliers

Some of the goods or services are commonly available with little variation in quality or availability. Such goods and services are called ***commodities***. The providers of commodities are ***suppliers*** and there are usually several from which to choose. Purchasing commodities from **suppliers** focuses on achieving the lowest cost. Additional cost savings are often available if large quantities of a commodity are purchased from the same supplier.

On larger, more complex projects, a list of materials and supplies is developed from the project cost **estimate**. This list is provided to **suppliers** as a***request for quote (RFQ)***, and the **suppliers** respond with their lowest price. To avoid choosing a ***bid***— a quote that lists the specific materials to be provided, the price for each, and a schedule for delivery– from a company that will make a promise it cannot keep, many organizations will maintain a list of **suppliers** that meet the organization's requirements. These requirements usually include the proven ability to meet the quality and schedule specifications.

The project management team develops a procedure for requesting a quote. On smaller projects, the parent purchasing organization may process all RFQs. On larger projects, a procurement organization is established with expertise in purchasing. The purchasing team will develop a list of all **procurement** requirements for the project and develop a procurement schedule that assures the materials will be available to the project when needed.

The project team develops an RFQ based on the quantity and schedule needs of the project and sends the RFQ to the identified qualified **suppliers**. The project team evaluates each quote from **suppliers** and determines that the supplier bid meets all the requirements, and in most cases, the supplier with the lowest price will be awarded the bid.

RFQ for Publishing Contractor

A publishing contractor who is drafting a series of ten math textbooks develops a materials list that includes all the supplies needed to publish all ten books. The contractor develops an RFQ for all these materials, including the writing schedule, and submits the RFQ to the four largest writing guild companies in the region. Each of the guild companies decides to bid on the project and provides a bid for the materials in the RFQ. One of the bidders has the lowest price but is unable to deliver the materials to the client site. The project team calculates the cost of transporting the materials to the client site. After the cost of transportation is added to the bid, it is no longer the lowest total cost. The bidder with the total lowest total cost is awarded the contract.

Some organizations that do a large number of projects will develop a relationship with one or two **suppliers** based on developing cost savings for both organizations. This relationship is commonly called a ***key supplier*** relationship.

Key Supplier for Publishing Supplies

The publishing contractor develops a key supplier relationship with one or two of the material supply companies. The material supply company would guarantee a 10% discount on all materials and the contractor would promise to purchase exclusively from the key supplier. Both organizations save the cost and time associated with preparing the bid. The publishing supply company plans on a consistent volume of business from the contractor and the contractor can expect priority treatment when supplies are scarce.

Vendors

Vendors often provide a unique product or service that cannot be readily purchased in the marketplace. The **vendor** typically provides a product or service that is designed for the project. The following are examples of products or services provided by **vendors**:

- Artwork
- Software developers and programs
- Publishers

Products and services from **vendors** need input and insight from the vendor. Instead of issuing a **request for quote (RFQ)** for a list of commodities, the project team issues a ***request for proposal (RFP)***. Companies responding to an RFP are invited to provide creative approaches to adding value to the project. Bidders are encouraged to offer design alternatives, alternative uses of materials, and scheduling alternatives that meet all the project requirements and also reduce the total project cost. The bids are evaluated on the total value to the project, including the contribution to the project goals.

Because vendor performance is critical to the success of the project, the management of the vendor relationship is a project management priority. Project management will often implement processes that encourage the **vendors** to submit suggestions that will reduce total project cost, shorten the schedule, or improve the performance. The project management team will often assign someone from the team to monitor the relationship and provide support from project resources to help assure vendor success.

Partners

If the parent organization lacks key skills or relationships, it might work with other organizations as partners—especially on international projects.

A ***partnership*** is a formal arrangement to execute the project with each party contributing resources. In most partnerships, both parties benefit from the success of the project and share the costs associated with a less successful project. Critical to the success of a partnership is the clear definition of roles and responsibilities on the project, a common understanding of the project goals, and a scope of work for each partner.

Building the relationship between major partners on the project is similar to building relationships with clients. On a large, complex project, a partnership alignment session is often required to build the trust required for open communication channels. Maintaining the relationship permits more effective problem solving and coordinated action on the project. A well-managed partnering relationship can contribute to the achievement of project goals, reduce overall costs, and shorten the project schedule. In most cases, the parent organization is aware of weaknesses in the project resources or skills and searches for a potential partner that has the needed resources or skills.

PR Partnership

On a project in Puerto Rico, an instructional design company wanted a Puerto Rican public relations firm to market their product because of their expertise with the locale. Both companies researched the capability of the other company to assure that the partnership was appropriate for each of them. This was a situation where a partnering relationship would benefit the project—both companies would mutually support each other to achieve project goals and both would benefit from project success.

In this situation, the project procurement plan specified the development of a subcontract for the PR services, and a contract was developed with a clear scope of work and a cost based on completing the work in the contract on time and according to specification. Because the project schedule required the PR firm to begin work before all the needed information was available, change orders were required when new information became available. The contract allowed several days to evaluate the impact of the change on cost and schedule, and the time evaluation process began to cause delays in the project.

Eventually, a new contract was developed to make the Puerto Rican company a partner. These new partnering arrangements allowed PR to get early information and contribute ideas that would shorten the schedule. This case is an example of the need to evaluate the project goals and environment and develop a procurement strategy that matches the conditions of the project.

KEY TAKEAWAYS

- Commodities are purchased through **suppliers** using a **request for quote (RFQ)** and selected on the basis of price. An exception is the key supplier relationship where the supplier-organization relationship is long term and the supplier passes along some of the savings of avoiding the bidding process.
- **Vendors** provide products and services that are designed for the project based on a **request for proposal (RFP)** that invites the **vendors** to meet the goals of the request using their products and skills.
- If the organization lacks key skills or relationships, it might form a partnership arrangement with another company to share the benefits and risks of the project.

9.5 Selecting the Type of Contract

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify factors that determine which type of contract to select.
2. Describe the types of fixed cost contracts.
3. Describe the types of cost reimbursable contracts.
4. Understand **progress payments** and how to reduce problems in changing the contractors' scope of work.

An agreement between the organization and an outside provider of a service or materials is a ***contract***. To limit misunderstandings and make them more legally binding, contracts are usually written documents that describe the obligations of both parties and are signed by those with authority to represent the interests of the parties.

Because legal agreements often create risk for the parent organization, procurement activities are often guided by the policies and procedures of the parent organization. After the project management team develops an understanding of what portions of the project work will be outsourced and defines the type of relationships that are needed to support the project execution plan, the procurement team begins to develop the ***contracting plan***. On smaller, less complex projects, the contract development and execution is typically managed through the parent company or by a part-time person assigned to the project. On larger, more complex projects, the procurement team can consist of work teams within the procurement function with special expertise in contracting. The contract plan defines the relationship between the project and the subcontractors (supplier, vendor, or partner) and also defines a process for making changes in the agreement to accommodate changes that will occur on the project. This **change management process** is similar to the **change management process** used with the project agreement with the project client.

Image by Campaign Creators

The **contracting plan** of the project supports the procurement approach of the project. The following are some factors to consider when selecting the type of contract:

- The uncertainty of the scope of work needed
- The party assuming the risk of unexpected cost increases
- The importance of meeting the scheduled milestone dates
- The need for predictable project costs

There are several types of contracting approaches and each supports different project environments and project approaches. The legal contracts that support the procurement plan consist of two general types of **contract**: the fixed-price and the cost-reimbursable contracts, with variations on each main type.

Fixed-Price Contracts

The ***fixed-price contract*** is a legal agreement between the project organization and an entity (person or company) to provide goods or services to the project at an agreed-on price. The contract usually details the **quality** of the goods or services, the timing needed to support the project, and the price for delivering goods or services. There are several variations of the fixed price contract. For commodities and goods and services where the scope of work is very clear and not likely to change, the fixed price contract offers a predictable cost. The responsibility for managing the work to meet the needs of the project is focused on the contractor. The project team tracks the **quality** and schedule progress to assure the contractors will meet the project needs. The risks associated with fixed price contracts are the costs associated with project change. If a change occurs on the project that requires a change order from the contractor, the price of the change is typically very high. Even when the price for changes is included in the original contract, changes on a fixed-price contract will create higher total project costs than other forms of contracts because the majority of the cost risk is transferred to the contractor, and most contractors will add a contingency to the contract to cover their additional risk.

Fixed-price contracts require the availability of at least two or more **suppliers** that have the qualifications and performance histories that assure the needs of the project can be met. The other requirement is a scope of work that is most likely not going to change. Developing a clear scope of work based on good information, creating a list of highly qualified bidders, and developing a clear contract that reflects that scope of work are critical aspects of a good fixed-priced contract.

If the service provider is responsible for incorporating all costs, including profit, into the agreed-on price, it is a ***fixed-total-cost contract***. The contractor assumes the risks for unexpected increases in labour and materials that are needed to provide the service or materials and in the materials and timeliness needed.

The ***fixed-price contract with price adjustment*** is used for unusually long projects that span years. The most common use of this type of contract is the inflation-adjusted price. In some countries, the value of its local currency can vary greatly in a few months, which affects the cost of local materials and labour. In periods of high inflation, the client assumes risk of higher costs due to inflation, and the contract price is adjusted based on an inflation index. The volatility of certain commodities can also be accounted for in a price adjustment contract. For example, if the price of oil significantly affects the costs of the project, the client can accept the oil price volatility risk and include a provision in the contract that would allow the contract price adjustment based on a change in the price of oil.

The ***fixed-price with incentive fee*** is a contract type that provides an incentive for performing on the project above the established baseline in the contract. The contract might include an incentive for completing the work on an important milestone for the project. Often contracts have a penalty clause if the work is not performed according to the contract. For example, if the new software is not completed in time to support the implementation of the training, the contract might penalize the software company a daily amount of money for every day the software is late. This type of penalty is often used when the software is critical to the project and the delay will cost the project significant money.

If the service or materials can be measured in standard units, but the amount needed is not known accurately, the price per unit can be fixed—a ***fixed unit price contract***. The project team assumes the responsibility of estimating the number of units used. If the **estimate** is not accurate, the contract does not need to be changed, but the project will exceed the budgeted cost.

Figure 9.10 Table of Fixed Price Contracts and Characteristics

Type	Known Scope	Share of Risk	Incentive for Meeting Milestones	Predictability of Cost
Fixed Total Cost	Very High	All Contractor	Low	Very High
Fixed Unit Price	High	Mostly Project	Low	High
Fixed price with Incentive Fee	High	Mostly Project	High	Medium-high
Fixed Fee with Price Adjustment	High	Mostly Project	Low	Medium

Cost-Reimbursable Contracts

In a***cost-reimbursable contract***, the organization agrees to pay the contractor for the cost of performing the service or providing the goods. Cost-reimbursable contracts are also known as ***cost-plus contracts***. Cost-reimbursable contracts are most often used when the scope of work or the costs for performing the work are not well known. The project uses a -reimbursable contract to pay the contractor for allowable expenses related to performing the work. Since the cost of the project is reimbursable, the contractor has much less risk associated with cost increases. When the costs of the work are not well known, a cost-reimbursable contract reduces the amount of money the bidders place in the bid to account for the risk associated with potential increases in costs. The contractor is also less motivated to find ways to reduce the cost of the project unless there are incentives for supporting the accomplishment of project goals.

Cost-reimbursable contracts require good documentation of the costs that occurred on the project to assure that the contractor gets paid for all the work performed and to assure that the organization is not paying for something that was not completed. The contractor is also paid an additional amount above the costs. There are several ways to compensate the contractor.

- A ***cost-reimbursable contract with a fixed fee*** provides the contractor with a fee, or profit amount, that is determined at the beginning of the contract and does not change.
- A ***cost-reimbursable contract with a percentage fee*** pays the contractor for costs plus a percentage of the costs, such as 5% of total allowable costs. The contractor is reimbursed for allowable costs and is paid a fee.
- A ***cost-reimbursable contract with an incentive fee*** is used to encourage performance in areas critical to the project. Often the contract attempts to motivate contractors to save or reduce project costs. The use of the cost reimbursable contract with an incentive fee is one way to motivate cost reduction behaviours.
- A ***cost-reimbursable contract with award fee*** reimburses the contractor for all allowable costs plus a fee that is based on performance criteria. The fee is typically based on goals or objectives that are more subjective. An amount of money is set aside for the contractor to earn through excellent performance, and the decision on how much to pay the contractor is left to the judgment of the project team. The amount is sufficient to motivate excellent performance.

On small activities that have a high uncertainty, the contractor might charge an hourly rate for labour, plus the cost of materials, plus a percentage of the total costs. This type of contract is called ***time and materials (T&M)***. Time is usually contracted on an hourly rate basis and the contractor usually submits time sheets and receipts for items purchased on the project. The project reimburses the contractor for the time spent based on an agreed-on rate and the actual cost of the materials. The fee is typically a percentage of the total cost.

Time and materials contracts are used on projects for work that is smaller in scope and has uncertainty or risk and the project, rather than the contractor, assumes the risk. Since the contractor will most likely include contingency in the price of other types of contracts to cover the high risk, T&M contracts provide lower total cost to the project.

Figure 9.11 Table of Contract Types and Characteristics

Cost Reimbursable (CR)	Known Scope	Share of Risk	Incentive for Meeting Milestones	Predictability of Cost
CR with Fixed Fee	Medium	Mostly Project	Low	Medium-high
CR with Percentage Fee	Medium	Mostly Project	Low	Medium-high
CR with Incentive Fee	Medium	Mostly Project	High	Medium
CR with Award Fee	Medium	Mostly Project	High	Medium
Time and Materials	Low	All Project	Low	Low

To minimize the risk to the project, the contract typically includes a not-to-exceed amount, which means the contract can only charge up to the agreed amount. The T&M contract allows the project to make adjustments as more information is available. The final cost of the work is not known until sufficient information is available to complete a more accurate **estimate**.

PROGRESS PAYMENTS AND CHANGE MANAGEMENT

Vendors and **suppliers** usually require payments during the life of the contract. On contracts that last several months, the contractor will incur significant cost and will want the project to pay for these costs as early as possible. Rather than wait until the end of the contract, a schedule of payments is typically developed as part of the contract and is connected to the completion of a defined amount of work or project **milestones**. These payments made before the end of the project and based on the progress of the work are called ***progress payments***. For example, the contract might develop a payment schedule that pays for the development of the curriculum, and payment is made when the curriculum is completed and accepted. There is a defined amount of work to be accomplished, a time frame for accomplishing that work, and a **quality** standard the work must achieve before the contractor is paid for the work.

Just as the project has a scope of work that defines what is included in the project and what work is outside the project, **vendors** and **suppliers** have a scope of work that defines what they will produce or supply to the company. (Partners typically share the project scope of work and may not have a separate scope of work.) Often changes occur on the project that require changes in the contractor's scope of work. How these changes will be managed during the life of the project is typically documented in the contract. Capturing these changes early, documenting what changed and how the change impacted the contract, and developing a change order (a change to the contract) are important to maintaining the progress of the project. Conflict among team members will often arise when changes are not documented or when the team cannot agree on the change. Developing and implementing an effective **change management process** for contractors and key **suppliers** will minimize this conflict and the potential negative effect on the project.

KEY TAKEAWAYS

- Contract selection is based on uncertainty of scope, assignment of risk, need for predictable costs, and the importance of meeting milestone dates.
- Total fixed cost is a single price where the scope is well defined. A fixed price with incentive contract offers a reward for finishing early or under budget or a penalty for being late. A fixed price with adjustment allows for increases in cost of materials or changes in currency values. A fixed unit price contract sets a price per unit, but the exact number of units is not known.
- In a cost reimbursable contract, the project pays for costs. A cost plus fixed fee contract assures the contractor of a known fee. A cost plus percentage fee calculates the fee as a percentage of the costs. A cost plus incentive fee sets goals for the contractor to achieve that would result in a bonus. A cost plus award fee is similar, but the goals are more subjective. **Time and materials contracts** pay for costs plus an hourly rate for the contractor's time.

- Payments to **vendors** and **suppliers** are required during the course of the project. A change management system needs to be in place when dealing with **vendors** and **suppliers**.

9.6 Procurement Process

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the components of the procurement plan.
2. Identify the decisions made when selecting the type of contract.
3. Describe how bidders are qualified, solicited, and chosen.
4. Identify the methods used to manage the contracts.

The project procurement cycle reflects the procurement activities from the decision to purchase the material or service through to the payment of bills and closing of procurement contracts.

Procurement Plan

After the decision has been made to purchase goods or outsource services, the procurement team develops a plan that includes the following:

- Selecting the appropriate relationships and contract approaches for each type of purchased goods or outsourced service
- Preparing RFQs and RFPs and evaluating partnership opportunities
- Evaluating RFQs, RFPs, and partnerships
- Awarding and signing contracts
- Managing **quality**, timely performance
- Managing contract changes
- Closing contracts


Image by Naassom Azevedo

Depending on the complexity level of the project, each of these steps can take either hours or sometimes weeks of work to complete. Each of these steps is also included in the project master schedule. The time involved in the procurement cycle can influence the scheduling of critical activities, including the decision to self-perform the work or contract the work to others. The equipment and materials delivery dates and completion of contracted work dates are placed on the project schedule and any procurement activities that create a project delay or fall on the project **critical path** may require special attention.

Selecting the Contract Approach

The technical teams typically develop a description of the work that will be outsourced. From this information, the project management team answers the following questions:

- Is the required work or materials a commodity, customized product or service, or unique skill or relationship?
- What type of relationship is needed: supplier, vendor, or partnership?
- How should the supplier, vendor, or potential partner be approached: RFQ, RFP, or personal contact?
- How well known is the scope of work?

- What are the risks and which party should assume which types of risk?
- Does the **procurement** of the service or goods affect activities on the project schedule's **critical path** and how much float is there on those activities?
- How important is it to be sure of the cost in advance?

The procurement team uses the answers to the first three questions listed above to determine the approach to obtaining the goods or services and the remaining questions to determine what type of contract is most appropriate.

A key factor in selecting the contract approach is determining which party will take the most risk. The team determines the level of risk that will be managed by the project and what risks will be transferred to the contractor. Typically, the project management team wants to manage the project risk, but in some cases, contractors have more expertise or control that enable them to better manage the risk associated with the contracted work.

Soliciting Bids

A ***solicitation*** is the process of requesting a price and supporting information from bidders. The **solicitation** usually takes the form of either an RFQ or an RFP. Partnerships are pursued and established on a case-by-case basis by senior management.

Qualifying Bidders

Potential bidders are people or organizations capable of providing the materials or performing the work required for the project. On smaller, less complex projects, the parent company typically has a list of **suppliers** and **vendors** that have successfully provided goods and services in the past, and the project has access to the performance record of companies on that list. On unique projects, where no supplier lists exist, the project team develops a list of potential **suppliers** and then qualifies them to become eligible to bid on project work. Eligible bidders are placed on the bidders list and provided with a schedule of when work on the project will be bid.

The eligibility of a supplier is determined by the ability to perform the work in a way that meets project requirements and demonstrates financial stability. Ability to perform the work includes the ability to meet **quality** specifications and meet the project schedule. During times when economic activity is high in a region, many **suppliers** become busy and stretch their resources. The project team investigates the potential **suppliers** to assure they have the capacity and the track record of meeting deadlines before they are included on the bidder's list.

The potential supplier must also be financially stable to be included on the bidders list. A credit check or a financial report from Dun and Bradstreet (D&B)—a well-known provider of financial information about individual companies—will provide the project with information about the potential bidder's financial status. D&B services include the following:

- D&B proprietary rankings and predictive creditworthiness scores
- Public filings, including suits, liens, judgments, and ***UCC filings***—standardized financial disclosure documents that conform to the uniform commercial code
- Comprehensive payment history, including D&B's Paydex Scores
- Company financial statements and history

Request for Quote

An RFQ focuses on price. The type of materials or service is well defined and can be obtained from several sources. The bidder that can meet the project **quality** and schedule requirements usually wins the contract by quoting the lowest price.

Request for Proposal

An RFP accounts for price but focuses on meeting the project **quality** or schedule requirements. The process of developing a proposal in response to an RFP can be very expensive for the bidder, and the project team should not issue an RFP to a company that is not eligible to win the bid.

Evaluating Bids

Evaluation of bids in response to RFQs for commodity items and services is heavily graded for price. In most cases, the lowest total price will win the contract. The total price will include the costs of the goods or services, any shipping or delivery costs, the value of any warranties, and any additional service that adds value to the project.

The evaluation of bids based on RFPs is more complex. The evaluation of proposals includes the price and also an evaluation of the technical approach chosen by the bidder. The project team evaluating the proposal must include people with the expertise to understand the technical aspects of the various proposal options and the value of each proposal to the project. On more complex projects, the administrative part of the proposal is evaluated and scored by one team, and the technical aspect of the proposal is evaluated by another team. The project team combines the two scores to determine the best proposal for the project.

Awarding the Contract

After the project team has selected the bidder that provides the best value to the project, a project representative validates all conditions of the bid and the contract with the potential contractor. Less complex awards, like contracts for printed materials, require a reading and signing of the contract to assure the printed materials supplier understands the contract terms and requirements of the project schedule. More complex projects require a detailed discussion of the goals, the potential barriers to accomplishing those goals, the project schedule and critical dates, and the processes for resolving conflicts and improving work processes.

Planning Session Follows Contract Award

On a design project to create a major training for a world-wide company, the project manager invited two critical partners to a three-day planning session after the project contracts were awarded.

The project manager began the session by stating that the project leadership intended to create an environment that enabled each of the partners to exceed profit expectations on the project and that the only way to accomplish this **goal** was through a mutually supportive team where everyone contributed to improve project performance and everyone benefited from better performance. The session then focused on developing ways to resolve problems and increase performance. Although this may appear to be a simple process of focusing contractors on project success, the process took several days of lengthy discussion and conflict resolution. The effort invested in developing alignment between the project team and contractors can significantly improve project performance.

Managing the Contracts

The contract type determines the level of effort and the skills needed to manage the contract. The manager of supplier contracts develops detailed specifications and assures compliance to these specifications. The manager of vendor contracts assures the contractors that bid the work have the skills and capacity to accomplish the work according to the project schedule and tracks the vendor's performance against the project needs, supplying support and direction when needed. The manager of partnering arrangements develops alignment around common goals and work processes. Each of these approaches requires different skills and various degrees of effort.

Items that take a long time to acquire—***long lead items***—receive early attention by the project leadership. Examples of long lead items are equipment that is designed and built specifically for the project, curriculum that is created for training a new workforce, and a customized bioreactor for a biotech project. These items might require weeks, months, and sometimes years to develop and complete. The project team identifies long lead items early to begin the procurement activities as soon as possible because those procured through the normal procurement cycle may cause delays in the project.

After the contract is awarded, the project team tracks the performance of the contractor against performance criteria in the contract and his or her contribution to the performance of the project. Typically, the contractors deliver the product or service that meets the **quality** expectations and supports the project schedule. Typically, there are also one or two contractors that do not perform to project expectations. Some project managers will then pull out the contract and attempt to persuade the contractor to improve performance or be penalized. Other project managers will explore with the contractor creative ways to improve performance and meet project requirements. The contract management allows for both approaches to deal with nonperforming contractors and the project team must assess what method is most likely to work in each situation.

Managing contractor performance on a project is as important to the overall project outcomes as the work performed by the project team.

Logistics and Expediting

Equipment and materials that are purchased for use on the project must be transported, inventoried, warehoused, and often secured. This area of expertise is called logistics. The logistics for the project can be managed by the project team or can be included in the RFP or RFQ. On international projects, materials may be imported, and the procurement team manages the customs process. On smaller projects, the logistical function is often provided by the parent company. On larger projects, these activities are typically contracted to companies that specialize in logistical services. On larger, more complex projects, that procurement team will include logistical expertise.

The project work often depends on materials procured for the project. The delivery of these materials influences the scheduling of the project, and often some materials are needed earlier than normal procurement practices would deliver. On long lead items, the project schedule is included in the contracting plans and contractors must explain how they will support the project schedule.

On large, complex projects, critical items might be scheduled for delivery after they are needed on the project. The procurement team then explores ideas with the contractor to expedite the manufacturing or transportation of the equipment or materials. The contract can often place a priority on the fabrication of the equipment and delivery of the equipment to meet the project schedule. The project logistics team can also explore ways of shortening the transportation time. For example, a project in Argentina flew some critical equipment from Sweden rather than transport the equipment by ship to save several weeks in transit. The logistics costs were higher, but the overall value to the project was greater.

KEY TAKEAWAYS

- The procurement plan includes determining the category of materials or services, choosing the type of contractual relationship, soliciting bids, selecting bidders, managing the work, and closing the contracts.
- The decisions made when selecting the type of contract are based on whether the materials can be provided by **suppliers**, **vendors**, or partners; how well defined the work is; how the risk will be shared; the importance of the task to the schedule; and the need for certainty of the cost.
- Companies that bid on contracts are evaluated on past performance and current financial status. RFQs and RFPs are sent to those companies. RFQs are evaluated on price and RFPs are evaluated on price and method.
- Long **lead time** items are identified and monitored. Items that are critical to the schedule or delayed are assigned to an expediter. The logistics of handling delivery, storage, and transportation are determined. Work and materials are inspected for **quality**.

CHAPTER 10

10 Managing Project Quality

10.0 Overview

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This chapter aligns with chapter 8 of the PMBOK and 7% of the CAPM questions come from this knowledge area. The content connects to the Planning, Executing and Monitoring & Controlling categories of the PMP questions.

Project quality has a very different definition under instructional design than it has in a traditional manufacturing setting. Nevertheless, no aspect of the final deliverable is more important than the actual **quality** and effectiveness of the educational materials.

Managing **project quality** within instructional design takes some ingenuity, since any assessment of a project's "**quality**" can differ depending on an individual's subjective criteria. The most important judges of the project's **quality** are your client and the people who will be using your training.

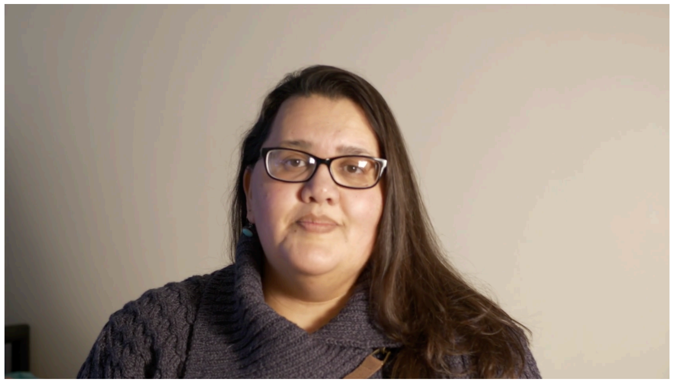
Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=192

When we try to judge the quality of a product, we need to take into consideration the expectations of the client and what we were contracted to do to begin with. Did we meet the contractual obligations? That's the number one level of judging quality? In my book, I always want to go back to that contract. What did we agree to do? Did we deliver? And if we didn't deliver the whole thing, what did we deliver? Click here to access transcript

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan



As an instructional designer, we'll use our professional judgment to gauge whether or not a course that we're working on with a subject matter expert has the rigour necessary to meet the credit requirements of what that college is wanting. Click here to access transcript.

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

Well the first thing that you do, is that you hire really capable people. You hire people who are really good at what they do. And you wait until you find the really good person that you want. We looked really hard for a cartoonist on this project. We were training submarine finding helicopter pilots, and sensor operators, military people, and we're going to have some cartooning in our art, we decided. We looked and we looked, and we waited and we waited until we found a really good cartoonist. Sometimes when you get the quality worker, you get all the quality workers quirks with him, and so, we had to manage this cartoonist. That was quite a revealing experience. So number one, you get the best people you can, people who are competent, people who are good because those people are also usually fast. The second thing you do is, you're innovative in your designs. You design your materials, how do you describe it? You design your materials so they can be created by, according to some kind of a pattern that people can get used to. You use those patterns as efficiency tools. You control costs by not having, in the early days of computer based instruction, people were so inventive, every piece of computer based instruction was different in some way. Uniquely, sometimes gothically so. Well, students had to learn a whole new system of navigating a lesson. Because in one lesson the controls would be up here, and in one lesson the controls would be down here. And so it became confusing. Designers eventually learned how to use screen designs that were consistent in the placement of controls. The worldwide web works that way today. The controls all work the same regardless of what web page you go to, more or less. One of the things you can do for designers is to find these patterns that designers use, I don't want to use the word templates, but templates is kind of what it is. Lesson patterns that they use, so that the lessons have the same internal structure. And so you've got one class of lessons, maybe you've got fifteen lessons of this type, that have this kind of a strategy that require this much writing, this much art. And so you know how much that packet costs. And then there is this kind over here. It's going to require this kind of graphics, this kind of writing and this amount. And so you use that as a projection tool. You have to know what the characteristics are of the thing that you're creating. The advent types become very important to you.

Heather Bryce – Independent Studies – BYU

How I balance quality and time and cost is really a factor of my boss. They make the decision on whether to do a course. Now if we know a course is going to be a high enroller, you have more money to play with on a course. If a course is a low enroller there might be different reasons for doing that. We have to be stricter about our budget. So when we meet at the very beginning with the designer, we talk about it and say, okay basically this is the budget that you've been given. And we've gotten more strict with budget, so then you can fudge with time or quality. Every project is different. Some projects, you have an absolute deadline that you have to have a course available. So then, at that point you say, okay, then do we fudge on the quality, or do we fudge on the cost? So it really depends on each project. For the project that I did, Art 45, we went with quality. That was the one that we weren't going to sacrifice, and so we sacrificed cost on that one. But there have been other projects that we've had, where time was a factor and we had to get it out. On those we said, okay, we'll have to not do those videos, because that's a cost. So we cut our cost and maybe possibly the quality. Every project is different.

Dr. Larry Seawright – Center for Teaching and Learning – BYU

So that's always a project manager's trade-off. How do you balance quality with time and money? If you had as much money, regardless of what the project is. Whether it's an instructional design project or building a bridge. If you have a lot of money and a lot of time you could make a great bridge. If you don't have as much money and you don't have as much time then your beautiful four lane bridge becomes a two lane bridge and hopefully it's still earthquake proof and all those kinds of things. So you manage those quality things, but you have to shrink things down. In our project, the BYU Learning Suite, we have a kind of, pretty fixed quality target, in that there is an existing learning management system. And so let's say the satisfaction level is here with the existing management system. So we have to at least hit that target. Now what we've had to do is define what that target is. Basically that means no outages, we can't look at the history of that learning management system and say, well when they first started there were lots of outages, and you know, things like that. We can't do that because when it first started they had one hundred faculty on it. We have eighty percent of the faculty now using the learning management system, and it affects virtually every student at Brigham Young University. We have to hit that level of reliability. What we could do is kind of take a look at the quality of the offering in terms of the number of features that are offered by the current learning management system and what we're going to initially offer in our new BYU Learning Suite learning management system. And what we did is we took a look at what are the features that are used by most of the faculty and students most of the time? And deliver those in a way that's easier to use than the existing system, just as reliable as the existing system. So those are kind of two quality elements that we looked at. It has to be just as reliable. And it has to be easier to use. And that's kind of difficult because we think, in our design, we think it's easier to use, but it's different, and so the users may not think it's easier to use initially. And so there's a training curve and a learning curve. After they use it a little bit they say, "Oh this is easier to use." But it's like going from one kind of vehicle to another. They're both automatic transitions, but the shift mechanism is on the column in one and on the middle panel on the other one. And some people just never get used to that. Same thing with the learning management system. You click here in one, and you click here in another. And people, they'll just never get used to it and they'll think it's not as good. Quality is so subjective in applications like this. You just have to do what you can. And then you provide instructional help to help address some of those kinds of issues. And that's kind of one of the roles of the project manager is you go through and you start evaluating as it comes close to completion, and you start testing it within users. You find out what are the issues that they have? And you build just in time help so that they can click that little help icon or the help with this page and it brings up appropriate help that says, "Oh, this is what that is, now I know what to do." You can address some quality issues with help, but you don't want to rely on that. But the old saying of, "it should be so easy, no help is needed." You can almost never rely on that. As much as you'd like too.

10.1 Standards of Quality and Statistics

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LEARNING OBJECTIVES

1. Define **quality** and grade.
2. Define and explain how **statistics** are used in **quality control**.
3. Estimate the likelihood of **samples** falling within one, two, or three **standard deviations** of the mean given a normal distribution caused by random factors.

Quality and Grade

According to the International Organization for Standardization (ISO), ***quality*** is "the degree to which a set of inherent characteristics fulfill requirements."[1] The requirements of a product or process can be categorized or given a grade to give a basis for comparison. The **quality** is determined by how well something meets the requirements of its grade.

Quality of Gasoline Grades

Image by Ksenia Kudelkina

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**.

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.

Quality *of Furniture Packing in John's Move*

John has antique furniture that is in excellent condition that was left to him by his grandmother. The pieces are important to John for sentimental reasons and they are also valuable. John decides to hire movers (high-grade professionals) to load his furniture into the truck using appropriate padding and restraints to prevent dents and scratches during the long trip to Saskatoon and then to unload the truck in Saskatoon. John's standard for high **quality** is that no observable damage occurs to his large pieces of furniture, especially the antiques. If the furniture arrives in his new apartment without a single dent, scratch, or other damage, the activity will be of high **quality**. John's standard for packing his kitchen is lower. His dishes are old and cheap, so he decides to trust his inexperienced friends (low-grade amateurs) to help him pack his kitchen. If a few of the dishes or glassware are chipped or broken in the process, the savings in labour cost will more than make up for the loss and were still a good value.

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—is useful when interpreting large numbers of measurements and is 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 between ***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 designs. Student assessments are one way in which instructional designers are able to tell whether learning occurs within the **control limits**.

Setting Control Limits in Gasoline Production

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 decide 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 are affecting 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.

Normal Distribution of Gasoline ***Samples***

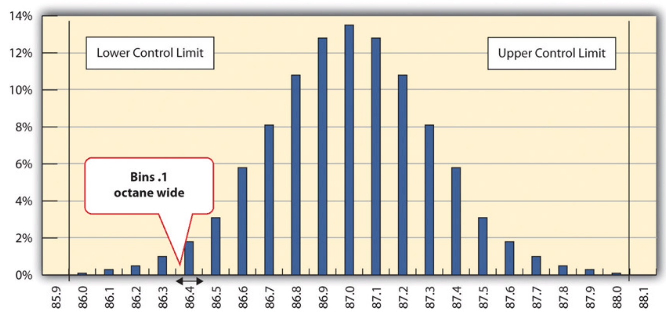
A refinery's quality control manager measures many **samples** of 87 octane gasoline, sorts the measurements by their octane rating into **bins** that are 0.1 octane wide, and then counts the number of measurements in each bin. Then she creates a

frequency distribution chart of the data, as shown in Figure 10.1, "Normal Distribution of Measurements of Gasoline **Samples**".

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 center of the distribution as they are in Figure 10.1, the average of those measurements is also the center 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 σ (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 10.1 Normal Distribution of Measurements of Gasoline **Samples**

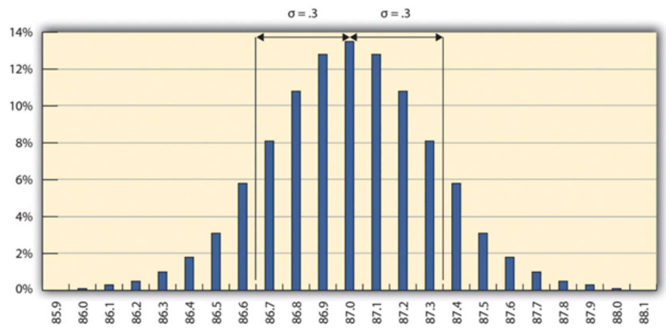


The chart shows that the most common measurements of octane rating are close to 87 and that the other measurements are distributed equally above and below 87. The shape of the distribution chart supports the **central limit theorem**'s assumption that the factors that are affecting the octane rating 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 concludes that the process is working satisfactorily.

*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 (see figure 10.2).

Figure 10.2 One Sigma Range



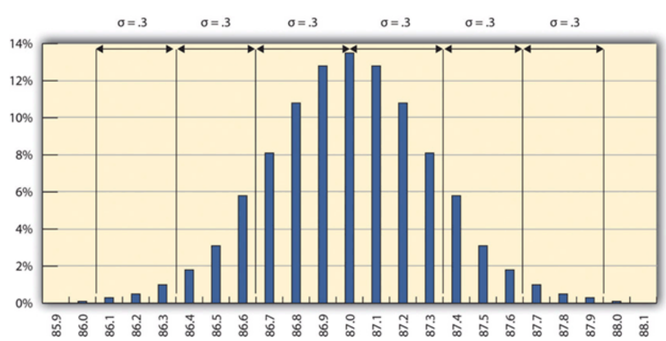
Most of the measurements are within 0.3 octane of 87.

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 5 feet 10 inches (70 inches) and the **standard deviation** is about 3 inches, you would know that 68% of the men in the United States are between five feet seven inches (67 inches) and six feet one inch (73 inches) in height. You would also know that about 95% of the adult men in the United States were between five feet four inches and six feet four inches tall, and that almost all of them (99.7%) are between five feet one inches and six feet seven inches tall. These figures are referred to as the ***68-95-99.7*** rule.

*Almost All **Samples** of Gasoline are Within Three STD*

The refinery's quality control manager marks the ranges included within two and three **standard deviations**, as shown below.

Figure 10.3 The 68-95-99.7 Rule



Some products must have less variability than others to meet their purpose. For example, if training designed to operate highly specialized and potentially dangerous machinery was assessed for **quality**, most participants would be expected to exceed the acceptable pass rate. Three **standard deviations** from the **control limits** might be fine for some products but not for others. In general, if the mean is six **standard deviations** from both **control limits**, the likelihood of a part exceeding the **control limits** from random variation is practically zero (2 in 1,000,000,000). (Refer to Figure 10.4)

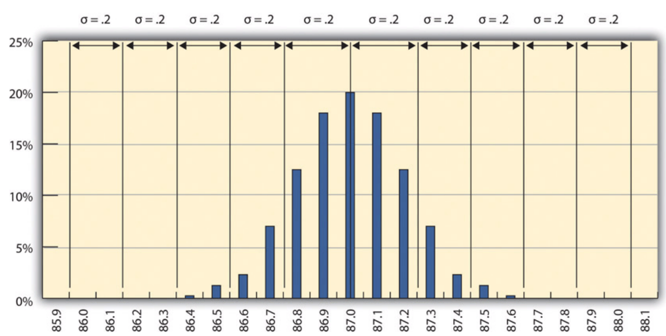
Figure 10.4 Meaning of Sigma Levels

Standard Deviations between Mean and Either Control Limit	Sigma Level	Percentage Inside Control Limits	Percentage Outside Control Limits	Parts Outside Control Limits (approximate)
1	1	68.3%	31.7%	32 per 100
2	2	95.4%	4.6%	5 per 100
3	3	99.7%	.3%	3 per 1,000
4	4	99.993 7%	.006 3%	4 per 100,000
5	5	99.999 94%	.000 06%	6 per 10 million
6	6	99.999 999 8%	.000 000 2%	2 per billion

A Step Project Improves ***Quality*** *of Gasoline*

A new refinery process is installed that produces fuels with less variability. The refinery's quality control manager takes a new set of **samples** and charts a new frequency distribution diagram, as shown below.

Figure 10.5 Smaller **Standard Deviation**



The refinery's quality control manager calculates that the new **standard deviation** is 0.2 octane. From this, he can use the 68-95-99.7 rule to estimate that 68.3% of the fuel produced will be between 86.8 and 87.2 and that 99.7% will be between 86.4 and 87.6 octane. A shorthand way of describing this amount of control is to say that it is a five-sigma production system, which refers to the five **standard deviations** between the mean and the control limit on each side.

KEY TAKEAWAYS

- **Quality** is the degree to which a product or service fulfills requirements and provides value for its price.
- **Statistics** is the mathematical interpretation of numerical data, and several statistical terms are used in **quality control**. **Control limits** are the boundaries of acceptable variation.
- If random factors cause variation, they will tend to cancel each other out—the **central limit theorem**. The central point in the distribution is the mean, which is represented by the Greek letter mu, μ. If you choose intervals called **bins** and count the number of **samples** that fall into each interval, the result is a frequency distribution. If you chart the distribution and the factors that cause variation are random, the **frequency distribution** is a normal distribution, which looks bell shaped.
- The center of the normal distribution is called the mean, and the average variation is calculated in a special way that

finds the average of the squares of the differences between **samples** and the mean and then takes the square root. This average difference is called the **standard deviation**, which is represented by the Greek letter sigma, σ.

- About 68% of the **samples** are within one **standard deviation**, 95.4% are within two, and 99.7% are within three.

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[1] International Organization for Standardization, Quality Management Systems—Fundamentals and Vocabulary (Geneva: ISO Press, 2005), in Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008), 190.

10.2 Development of Quality as a Competitive Advantage

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the historical events and forces that led up to today's emphasis on **quality** as a competitive requirement.
2. Describe **quality** awards in Japan and the United States.
3. Describe **quality** programs and standards such as TQM, **Six Sigma**, and ISO 9000.
4. Describe and calculate the cost of **quality**.

Quality management is an approach to work that has become increasingly important in every field, including instructional design, as global cooperation and competition have increased. A review of the history of quality management explains why it is so important for you to understand and why clients often require documentation to show that your processes satisfy their quality standards.

HISTORY

Prior to the late 1700s, products such as firearms and clocks were made as unique, individual works. If a part broke, a new one had to be made by hand to fit. In 1790 in France, Honoré Blanc demonstrated that he could make musket parts so nearly identical that a musket could be assembled from **bins** of parts chosen at random.[1] The practice of making parts to a high level of accuracy in their dimensions and finishes made the parts interchangeable. The use of interchangeable parts became the founding principle of assembly-line manufacturing to produce all manner of goods from sewing machines to automobiles to computer chips. The manufacturers of firearms and weapons were often the leaders in improving **quality** because reliable and safe operation of weapons and their rapid repair is a matter of life and death.

Statistical Control in the United States During World War II

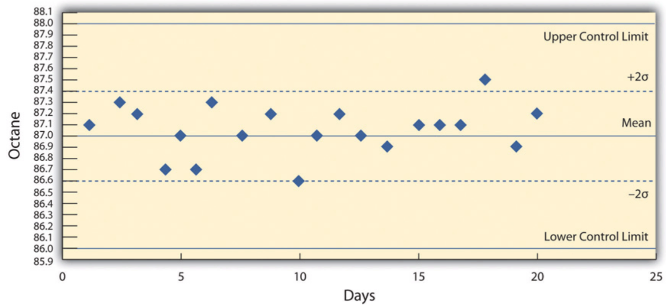
During World War II, factories were converted from manufacturing consumer goods to weapons. War plants had to make large numbers of parts as fast as possible while doing it safely for the workers and for the service members who used them. Important improvements in ***quality control*** **(QC)**—the management of production standards through statistical interpretation of random product measurements, which emphasizes consistency and accuracy—were made during this period.

A key figure in the history of quality management who was an important person in the war effort was Walter Shewhart at Bell Telephone Laboratories. Shewhart recognized that real processes seldom behaved like theoretical random distributions and tended to change with time. He separated causes of variation into two categories: ***chance cause*** and ***assignable cause***. Chance causes could be ignored if they did not cause too much variation, and trying to eliminate them often made the problem worse, but assignable causes could be fixed. To help distinguish between variations caused by random events and trends that indicated assignable causes, Shewhart introduced the ***control chart***, which is also known as a type of run chart because data are collected while the process is running. A control chart has time on the bottom axis and a plot of sample measurements. The mean, upper control limit, lower control limit, and warning lines that are two sigma from the mean are indicated by horizontal lines.

Control Chart Shows Production Variation of Gasoline

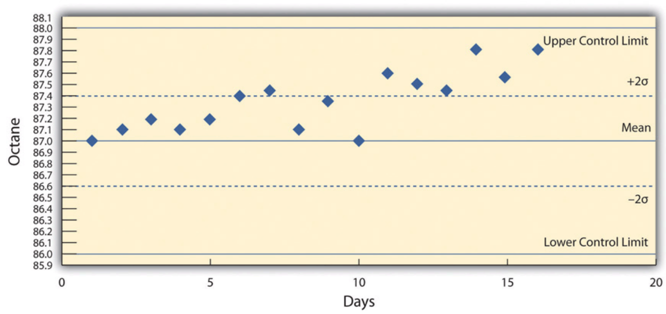
The refinery quality control manager takes **samples** each day of the 87 octane gasoline for twenty days and charts the data on a control chart, as shown below.

Figure 10.6 Control Chart Displaying Variations Due to Chance Causes



She recognizes that the highest and lowest measurements are not part of a trend and are probably due to chance causes. However, the control chart from the next twenty days, as shown below, indicates an upward trend that might be due to an **assignable cause**. She alerts the process manager to let him know that there is a problem that needs to be fixed before the product exceeds the upper control limit. This might indicate the need to initiate a project to fix the problem.

Figure 10.7 Control Chart Displaying Variations That Might Be Due to an **Assignable Cause**



Deming and Postwar Japan

The most influential person in modern **quality control** was an American who was a hero in Japan but virtually unknown in the United States. W. Edwards Deming worked with Shewhart at Bell Labs and helped apply Shewhart's ideas to American manufacturing processes during World War II. Following the war, American factories returned to the production of consumer goods. Many of the other major manufacturing centers in the world had been damaged by bombing during the war and took time to recover. Without the safety needs of wartime and with little competition, **quality control** was not a high priority for American companies.[2] Management in the United States focused on increasing production to meet demand and lowering costs to increase profits.

After the war, while the United States occupied Japan, Deming was asked by the U.S. Department of the Army to assist with the **statistics** of the 1950 census in Japan. Kenichi Koyanagi, the managing director of the Union of Japanese Scientists and Engineers and a very influential industrialist, asked Deming to speak to twenty-one top industrial leaders on the topic of global strategy for Japanese industry. Deming went beyond Shewhart's work and talked about his philosophy of quality manufacturing and how the responsibility for **quality** begins with management. He explained that a corporate **culture** devoted to producing high-**quality** products would result in less waste, lower costs, greater client loyalty, and greater market share. With Koyanagi's support, Deming's ideas were widely adopted by these influential leaders.

Deming described his philosophy as a system of profound knowledge, which has four parts:

1. Appreciation of a system. Understanding how **suppliers**, producers, and clients interact.

2. Knowledge of variation. Understanding statistical variation.
3. Theory of knowledge. Understanding what can be known and what cannot.
4. Knowledge of psychology. Understanding human nature.

In 1950, the Japanese created the *Deming prize* in Deming's honor, which is awarded to an individual and a company for major advances in **quality** improvements. In 1960, Deming was awarded the Order of the Sacred Treasure, Second Class by the Prime Minister on behalf of Emperor Hirohito.

Quality Management in North America

By the 1970s, Japanese companies had a reputation for high **quality** and were taking market share from American companies, but Deming's teachings were virtually unknown in his own country. It was not until 1980 that America became aware of Deming when his work was described in an NBC documentary titled *If Japan Can, Why Can't We?*[3] By then, Deming was eighty years old and the producer of the show originally assumed he was dead.[4]

Image by Shane Global Language Centres

In 1982, Deming's book was published and later retitled *Out of Crisis*, in 1986.[5] It was aimed at explaining his system to American manufacturers and the American public. In the book, Deming described fourteen principles of management to guide the implementation of his philosophy. Some of them were challenges to Western managers and very different from the thinking that was prevalent at the time. In brief, they are as follows:

1. Create constancy of purpose toward improvement of product and service.
2. Adopt a new philosophy. We are in a new economic age. Western management must awaken to the challenge, learn their responsibilities, and take on leadership for a change.
3. Cease dependence on inspection to achieve **quality**. Eliminate the need for inspection on a mass basis by building **quality** into the product in the first place.
4. End the practice of awarding business on the basis of price alone. Instead, minimize cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. Improve constantly and forever the system of production and service to improve **quality** and productivity and thus constantly decrease costs.
6. Institute training on the job.
7. Institute leadership. The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of an overhaul, as well as supervision of production workers.
8. Drive out fear, so that everyone may work effectively for the company.
9. Break down barriers between departments.
10. Eliminate slogans, exhortations, and targets for the workforce asking for zero defects and new levels of productivity.
11. Eliminate work standards (quotas) on the factory floor. Substitute leadership.
12. Remove barriers that rob the hourly worker of his right to pride of workmanship.
13. Institute a vigorous program of education and self-improvement.
14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

Between 1979 and 1982, Ford Motor Company lost $3 billion, and they were looking for solutions to their problems. They chose to apply Deming's approach to develop the new Taurus-Sable model and by 1986 had become the most profitable American auto company.[6]

Ford adopted a Japanese approach to **quality** known in America as ***total quality management*** **(TQM)**. TQM in Japan has four major components:

1. ***Kaizen.*** Improvement must involve all members of a company.[7]
2. ***Atarimae hinshitsu***. Make things work the way they are supposed to work.[8]
3. ***Kansei.*** Learn from the way a user applies the product to make improvements.[9]
4. ***Miryokuteki hinshitsu.*** Things should have an aesthetic **quality** and be pleasing to use.[10]

According to Peter B. Petersen,[11] TQM differs from the Deming approach in four fundamental ways:

1. The Deming approach represents one philosophy that is used in its entirety or not at all. In contrast, TQM can be tailored to a particular environment.
2. Both agree that a long-term commitment is required by top management. However, Deming would drop clients if they started to wane, while TQM consultants were less demanding.
3. Deming insists on constancy of purpose, while TQM adapts to the situation, which results in a lack of constancy.
4. Deming requires adoption of his principles of profound knowledge, while TQM lacks this unified philosophy.

Many poorly **qualified** consulting firms provided training in TQM to American companies. The approach worked in some cases but not in others where it was applied superficially, and the movement's credibility was diminished.

In Canada, the Canada Awards for Business Excellence, recognizing organizational excellence and continuous **quality** improvement across a wide range of business **quality** metrics, were first awarded in 1984 through the federal department of Industry, Trade and Commerce (Industry Canada). These awards are still presented today, although the program is now administered by Excellence Canada. Excellence Canada (formerly the National Quality Institute) is a nonprofit organization that provides certification, training, and recognition for **quality** in the workplace. They have helped thousands of organizations across Canada in a wide range of industry sectors to implement **quality** initiatives and strategies and programs to improve employee wellness.[1]

Another approach to quality management in the United States was formulated at Motorola in 1986 and was named ***Six Sigma*** (6σ). The **Six Sigma** practices were based on Deming's work, TQM, and others and had similarities regarding continuous efforts at improvement involving everyone at the company. It emphasized a clear focus on achieving quantifiable financial returns from any **Six Sigma** project. To determine the financial return on a quality initiative, the ***cost of quality*** (COQ) must be determined. The cost of **quality** has two parts: the cost of prevention and the cost of failure (or nonconformance). The cost of quality is the difference between the additional money spent on prevention and the corresponding reduction in the cost of failure.

Cost of prevention

1. Cost of conformance. Cost to improve **quality**
2. Cost of appraisal. Cost to measure and evaluate **quality**

Cost of failure

1. Internal costs. Repairing bad parts before shipment or retooling a manufacturing line to reduce failures
2. External costs. Managing returns, lawsuits, product recalls

The name **Six Sigma** refers to a process that has six **standard deviations** from the mean to either control limit that would ensure virtually zero defects. This approach was adopted by Jack Welch at General Electric with great success. By the late 1990s, about two-thirds of the top five hundred companies in the United States had begun **Six Sigma** projects, including Ford, which had allowed its **quality** programs to slip. To provide encouragement and a consistent standard, the U.S. government created the ***Malcolm Baldrige National Quality Award*** in 1987 to encourage companies to improve **quality**; the award was named for Malcolm Baldrige who was the U.S. secretary of commerce from 1981 to 1987.[12] The criteria used to determine award winners are as follows:

1. Leadership of senior executives
2. Strategic planning
3. Customer and market focus

1. https://excellence.ca/about-us

4. Measurement, analysis, and knowledge management
5. Workforce focus
6. Process management
7. Results

Often, instructional designers will be working with others who focus on **quality** within their organizations. **Quality** is usually associated with the evaluation portion of instructional design. It is important to understand the current quality management models that are employed so that evaluation of a design can be in line with organizational expectations.

Trade and International Standards

Trade between countries increased as countries recovered from WWII and began producing consumer goods. In 1948, the General Agreement on Tariffs and Trade (GATT) established the rules for international trade in the postwar world. Through years of negotiations based on GATT, the ***World Trade Organization*** (WTO) was created in 1995. The WTO is a negotiating forum where governments can discuss ways to help trade flow as freely as possible.[13]

Increases in trade forced companies to improve the **quality** of their products to compete for clients and to exchange parts reliably between companies that used parts **suppliers**. To assist in developing standards for **quality** that would be the same between countries, an organization of 158 national standards groups formed the ***International Organization for Standardization*** (ISO), which is headquartered in Switzerland. There are thousands of ISO standards, and they are grouped by their numbers. The ISO 9000 group of standards relate to **quality**.

Recommended steps for implementing a quality management system (QMS) are as follows:

1. Fully engage top management.
2. Identify key processes and the interactions needed to meet **quality** objectives.
3. Implement and manage the QMS and its processes.
4. Build your ISO 9001-based QMS.
5. Implement the system, train company staff, and verify effective operation of your processes.
6. Manage your QMS—focus on client satisfaction, strive for continual improvement.
7. If necessary, seek third-party certification and registration of the QMS, or alternatively, issue a self-declaration of conformity.[14]

KEY TAKEAWAYS

- The need for production of safe, reliable weapons that could be mass produced led to use of methods to assure that parts were manufactured within controlled limits. An early example is the interchangeable musket parts produced in France in 1790 and, later, the **quality control** methods introduced by Shewhart in the United States during World War II.
- Following World War II, Japanese companies followed advice from Deming and others to make **quality** a top priority for management. Higher-quality products gave Japan a competitive advantage with U.S. consumers that forced U.S. firms to respond with similar quality programs.
- The Deming award is given by Japan to companies doing business in Japan for high-**quality** standards. Similarly, the Baldrige National Quality Award is given to U.S. companies and individuals for their contribution to quality.
- **Total quality management** is a flexible program that is adapted from Japanese practices that emphasize kaizen, participation by all; **atarimaie hinshitsu**, making things work the way they should; **kansei**, learning from the way the client uses the product to make improvements; and **miryokuteki hinshitsu**, giving products an aesthetic **quality** to make them pleasing to use. **Six Sigma** identifies specialists within the organization and assigns titles like Master Black Belt. Each quality project must evaluate the cost of quality to gain approval.
- The International Standards Institute devises guidelines for establishing practices. The ISO 9000 group are guidelines for establishing practices that are likely to create **quality** products.
- The cost of **quality** has two parts: the cost of prevention and the cost of failure. The cost of prevention includes costs to establish **quality** practices and the costs to verify them. The cost of failure includes internal costs before the product is sold, such as waste and fixing products, while external costs include those that occur after the product is sold, such as returns and lawsuits.

[1] Ken Alder, “Innovation and Amnesia: Engineering Rationality and the Fate of Interchangeable Parts Manufacturing in France,” Technology and Culture 38, no 2 (April 1997): 273–311.

[2] John Dowd, “How the Japanese Learned to Compete,” Asia Times, October 27, 2006,http://www.atimes.com/atimes/Japan/HJ27Dh01.html (accessed August 11, 2009).

[3] John Dowd, “How the Japanese Learned to Compete,” Asia Times, October 27, 2006,http://www.atimes.com/atimes/Japan/HJ27Dh01.html (accessed August 11, 2009).

[4] Thomas J. Boardman, “The Statistician Who Changed the World: W. Edwards Deming, 1900–1993,” The American Statistician 48 (August 1994): 179–87.

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[6] Andrea Gabor, “Ford Embraces Six-Sigma Quality Goals,” June 13, 2001, http://andreagabor.com/selected-articles/management-quality-revival-part-2-ford-embraces-six-sigma/ (accessed December 4, 2012).

[7] Encyclopedia Britannica, s.v. “Total Quality Control,”http://www.britannica.com/EBchecked/topic/1387304/Total-Quality-Control (accessed August 13, 2009).

[8] NationMaster.com, “Miryokuteki Hinshitsu,” 2005,http://www.statemaster.com/encyclopedia/Miryokuteki-Hinshitsu (accessed August 14, 2009).

[9] WASEDA University, “Kansei Quality,”http://www.tqm.mgmt.waseda.ac.jp/study/kansei_e.html (accessed June 20, 2010).

[10] NationMaster.com, “Miryokuteki Hinshitsu,” 2005,http://www.statemaster.com/encyclopedia/Miryokuteki-Hinshitsu (accessed August 14, 2009).

[11] Peter B. Petersen, “Total Quality Management and the Deming Approach to Quality Management,” Journal of Management History 5, no. 8 (1999): 468–88.

[12] National Institute of Standards and Technology, “Frequently Asked Questions about the Malcolm Baldrige National Quality Award,” November 25, 2008,http://www.nist.gov/public_affairs/factsheet/baldfaqs.cfm (accessed August 14, 2009).

[13] World Trade Organization, “Understanding the WTO: Basics,”http://www.wto.org/english/thewto_e/whatis_e/tif_e/fact1_e.htm (accessed August 14, 2009).

[14] International Organization for Standardization, Quality Management Systems—Fundamentals and Vocabulary (Geneva: ISO Press, 2005), in Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008).

10.3 Relevance of Quality Programs to Project Quality

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify the similarities between process quality management and project quality management.
2. Identify the differences between process quality management and project quality management.

PROCESS V. PROJECT QUALITY MANAGEMENT

Image by icsa

Project quality refers to two distinct aspects of the project. The first aspect is the **quality** of the product or service delivered by the project. Does the end product meet client specifications? For example, does a software development project develop a program that performs to the client's requirements? A software program that performs the basic work functions but does not integrate with existing software would not be considered a quality product, as long as the client specified that the software must interface with existing software.

The second aspect of **project quality** is managing the project efficiently and effectively. Almost any client specification can be met if the project manager has unlimited time and resources. Recall that high **quality** means meeting the requirements for a particular grade while providing value. Meeting project deliverables within the time and resource constraints is also a measure of **project quality**. Developing a **project execution plan** that matches the complexity level of the project is the most critical aspect in developing a project plan that meets project specifications within the time frame and at the lowest costs. These two aspects of **project quality** have similarities and differences to **quality** as applied to parent organizations.

Similarities

All successful quality programs have (1) a requirement for commitment to **quality** by all the employees and their partners and (2) an emphasis on error prevention and client satisfaction. To comply with TQM, **Six Sigma**, ISO, or other **quality** standards required by the client or by the project management firm, the project manager must engage in quality programs and provide documents that specifically comply with the **quality** standards in use. For example, a project is typically required to follow the parent organization's work processes related to procurement and document management. Any project's processes that interface with the organization's **quality** processes will be required to meet the **quality** standards of the organization.

If a large project involves repetitive processes such as repeated modules in an online training course, statistical processes control methods can be used to maintain the quality of the product. These process control methods are similar to those used by **process managers** in the manufacturing environment. The intent is for the work of the project to meet design specifications. The modules, for example, if repeated could be assessed to determine whether they consistently meet the quality standards of the project. The **programmers** design the modules to meet certain criteria that will support a structure. The criteria, detailed in the design specifications, provide the **parameters** that the instructional designers must meet when designing the course. On large projects the use of **quality control** tools and methods are critical to meeting design specifications.

Differences

Because projects are temporary, spotting trends in **samples** produced by repetitive processes is not as important as considering **quality** in the planning of the project. Instead, the project manager must be able to provide documentation that demonstrates that the correct processes are in place to prevent **quality** failures.

The cost of quality (COQ) must be considered in the scope document and the project budget. If the group or company that is providing the project management is separate from the client, the project budget will bear the cost of prevention while the client will reap the rewards of avoiding the costs of failure. If senior management does not recognize the benefit to the organization of reducing cost of failure by spending more on prevention during the project, the project manager can be placed in the position of producing a product or service that he or she knows could be of higher **quality**.

If the cost of quality is not specifically considered and approved by senior management in the scope of the project, **quality** might be sacrificed during the project to meet budget goals.

Cost of Quality in a Learning Management System

At a Midwestern university, a new learning management system was being implemented. To reduce the cost of the system and avoid a late penalty, the project manager purchased and installed inferior server capacity. The less expensive system could only handle the current size of the university's processing load. Five years after the learning management system went online, the university had grown to far exceed the capabilities of their server architecture. The university did not take the time to specify the **quality** of the learning management system in the scope statement and was not aware of the implication of the inferior system at the time it was made. As a result, the cost of quality was lower in the prevention category but much higher in the cost of failure category. Because each party acted in their own interests instead of the interest of the university, and **quality** was not a priority, waste occurred and total cost increased.

Some separation of responsibility for **quality** is necessary. For example, if a project is undertaken to build a facility that makes something, it is important to distinguish between the **quality** of the work done by the project team and the **quality** of the items produced after the project is over. The client provides specifications for the facility that should result in production of **quality** products. It is the client's responsibility to provide appropriate project requirements that will result in a facility that can produce **quality** products. It is the project manager's responsibility to meet the project requirements. The project manager must focus on meeting requirements for project activities, but as part of the quality team, opportunities to improve the **quality** of the final product should be discussed with the client. If the final products fail to meet **quality** standards, someone will be blamed for the failure. It could be the project manager, even if he or she met all the requirements of the project specified by the client.

Cost of Prevention in Safety Training

An electronic parts manufacturer chooses to expand operations and needs to hire and train fifty employees. It uses its own human resources department to handle the selection and hiring of the employees, but it contracts with a nearby technical college to provide some of the training. The technical college is responsible for designing and delivering training on the topic of plant safety practices. The objective of the training project is to reduce the number of workplace accidents, but that is not the characteristic by which the **quality** of the training program is determined because the rate of accidents for employees who go through the training will not be known until after they have been employed for months or years. The criteria for determining the **quality** of the training must be something that can be controlled and measured by the project manager during the project.

Because projects are time sensitive, meeting activity finish dates is a common characteristic of **quality** work on a project that is not typical of a requirement of a process manager.

Timely Delivery Part of ***Quality***

While developing training for a national event, certain deadlines were already set. If the event is scheduled for 6 months out, then those volunteering will need appropriate training before the event. If the training is designed and developed to specifications, but is delivered without enough time before the event, then the **quality** of the product is poor regardless of the effectiveness of the training.

KEY TAKEAWAYS

- Both project and process quality management require commitment from all employees, including top management. They are both client oriented and prevention oriented.
- Projects are temporary and allow fewer opportunities to improve repetitive processes. Cost of prevention is often part of the project budget, but the cost of failure usually happens after the project is completed. This separation of costs and benefits can lead to taking short-term savings on the project at the expense of higher cost of failure after the project is complete.

10.4.1 Instructional Design Case Study

Project Quality: Case Study

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, and ongoing action is required to ensure that they are maintained.

On May 18, 2000, schools in Walkerton, ON reported 57 ill or absent students. By the next day, a retirement home reported an outbreak of gastroenteritis among residents, and the local hospital had dozens of emergency room patients suffering from the same illness. Hundreds more people called the hospital, describing similar symptoms.

Walkerton is located in an agricultural area, and one of the three wells supplying the town's water had become contaminated by E. coli due to rainwater runoff. The well water had been improperly treated and resulted in virtually everyone in the town of 5,000 being exposed to unsafe drinking water. By the time the cause of the outbreak was tracked down and contained, 2,300 people had become sick and seven were dead.[1]

In the aftermath of this public health disaster, a coroner's inquest, a police investigation, and a provincial public inquiry were held. The outcome of the inquiry, the Walkerton Report, identified a series of systemic failures and human errors. Brothers Stan and Frank Koebel were the supervisors of the Public Utilities Commission at the time, with certification as water distribution operators received through a grandfathering of the licensing process, and not through actual formal education. They were both charged following a criminal investigation that revealed falsified reports and drinking on the job. The inquiry also revealed many improper operating procedures, including incorrect sample collection, poor system monitoring, and insufficient chlorination. The Public Utilities Commissioners in charge of oversight had inadequate knowledge and no review processes in place. When contamination was identified, this information was not disseminated to public health officials quickly enough or with enough emphasis on the dangers that the situation posed.[2]

Some critics laid blame for this tragedy on the various levels of government for cutbacks and too much emphasis on budgetary matters at the expense of public safety. Others argued that this tragedy would have been entirely avoidable had processes been enforced and maintained through a quality management system for water suppliers, attention to benchmarks, and adequate training and supervision for operators and managers. Were the Koebel brothers truly responsible, or were they scapegoats? How can elected officials, civil servants, and ultimately, all project managers ensure a balance between controlling costs while still maintaining quality? In what ways does planning influence a quality end product?

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[1] Salvadori, M. I., Sontrop, J. M., Garg, A. X., Moist, L. M., Suri, R. S., & Clark, W. F. (2009). Factors that led to the Walkerton tragedy. Kidney International, 75, S33–S34. https://doi.org/10.1038/ki.2008.616

[2] Walkerton E. coli outbreak. (2021). In Wikipedia.https://en.wikipedia.org/w/index.php?title=Walkerton_E._coli_outbreak&oldid=1000236910

10.4.2 Planning and Controlling Project Quality

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Define statistical measurement terminology.
2. Identify sources of information for the planning process.
3. Identify and describe the techniques for controlling **project quality**.
4. Describe the results of planning and controlling **quality**.

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, ±.

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 only be invited 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 the client's expectations.

Project surveys can capture how the client perceives the project performance and provide the project team with data that is 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 improved.

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 the project faces 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.

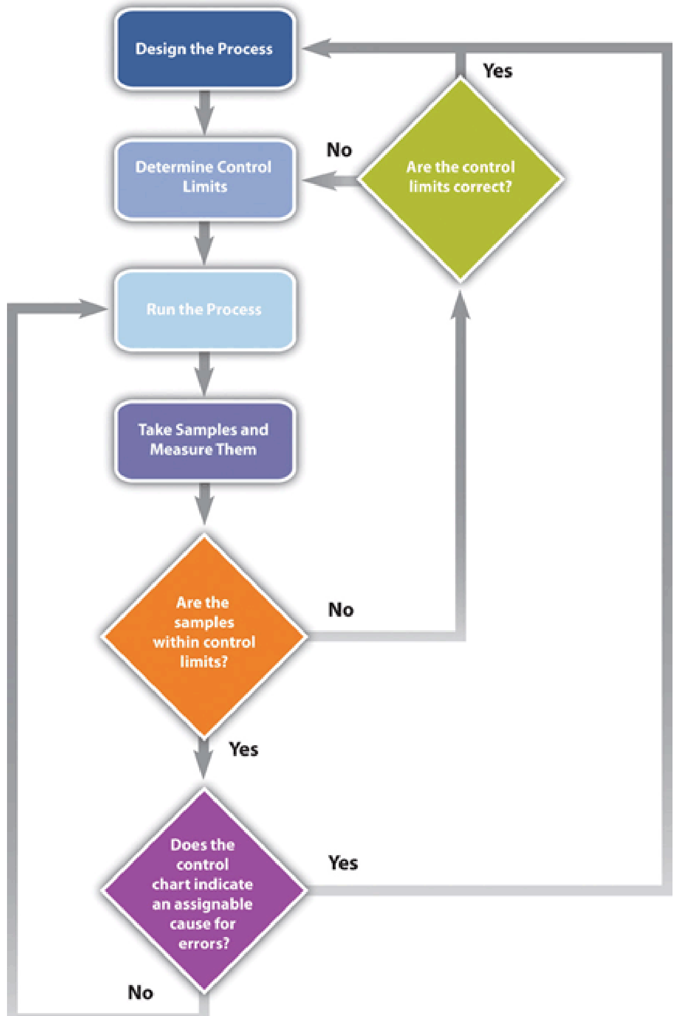
Quality Management Methodology

The quality management methodology required by the client is used. The project manager must provide the documentation the client needs to prove compliance with their methodology. There are several different quality management methodologies, but they usually have characteristics that are similar to the ones described previously in the text.

Flowcharting

Many processes are more complicated than a simple sequence of related events that include several different paths. A ***flowchart*** uses standard symbols to diagram a process that has branches or loops. Diamonds indicate decisions, and arrows indicate the direction of the flow of the process, as shown in Figure 10.8.

Figure 10.8 Flowchart of a **Quality Control** Process



The process used to plan and assess **quality** can be described using flowcharts. They are useful for communicating processes that have logical branches that can be determined by simple yes or no questions. Flowcharting is also useful for discovering misunderstanding in project roles and responsibilities and communicating responsibility for work processes.

Benchmarking

When products like shoes were made by hand, artisans would seek some degree of standardization by marking standard lengths for different parts of the product on their workbench. In modern management practice, if a particular method or product is a standard of **quality**, comparing your organization's **quality** plan to it is called ***benchmarking***. If a product or service is similar to something that is done in another industry or by a competitor, the project planners can look at the best practices that are used by others and use them as a comparison.

Cost-to-Benefit Analysis

Because the cost of prevention is more often part of the project budget, the case must be made for increasing the project t programs, like **Six Sigma**, require that expenditures for **quality** are justified using a cost-to-benefit analysis that is similar to calculating the cost of quality, except that it is a ratio of cost of increasing quality to the resulting benefit. A cost-benefit analysis in some **quality** programs can take into account nonfinancial factors such as client loyalty and improvements to corporate image and the cost-to-benefit analysis takes the form of a written analysis rather than a simple numeric ratio. It is similar to determining the cost of quality (COQ).

Design of Experiments

Measuring for **quality** of manufactured products or use of repetitive processes requires taking **samples**. Specialists in **quality control** design a test regimen that complies with statistical requirements to be sure that enough **samples** are taken to be reasonably confident that the analysis is reliable. In project management, the testing experiments are designed as part of the **planning phase** and then used to collect data during the **execution phase**.

Control Charts

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.

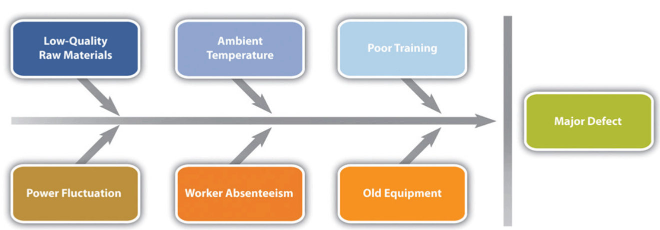
Cause and Effect Diagrams

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.

Diagramming Quality Problems

For example, a small manufacturing firm tries to identify the assignable causes to variations in its manufacturing line. They assemble a team that identifies six possibilities, as shown in the fishbone diagram below.

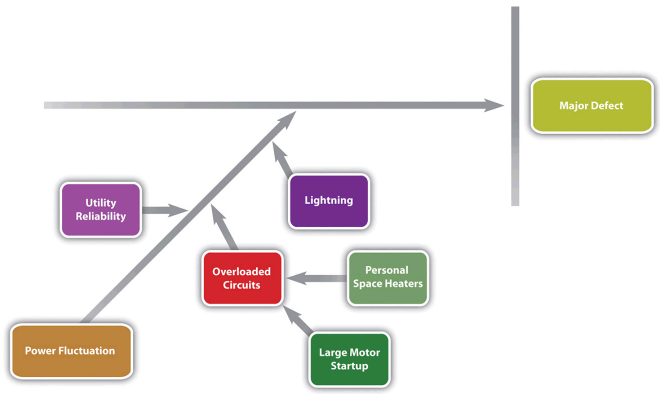
Figure 10.9 Cause and Effect Diagram



Each branch of the diagram can be expanded to break down a category into more specific items.

An engineer and the electrician work on one of the branches to consider possible causes of power fluctuation and add detail to their part of the fishbone diagram, as shown below.

Figure 10.10 Possible Causes of Power Fluctuation



Check Sheets, Histograms, and Pareto Charts

When several **quality** problems need to be solved, a project manager must choose which ones to address first. One way to prioritize **quality** problems is to determine which ones occur most frequently. This data can be collected using a ***check sheet***, which is a basic form on which the user can make a check in the appropriate box each time a problem occurs or by automating the data collection process using the appropriate technology. Once the data are collected, they can be analyzed by creating a type of frequency distribution chart called a ***histogram***. A true histogram is a column chart where the width of the columns fill the available space on the horizontal axis and are proportional to the category values displayed on the x axis, while the height of the columns is proportional to the frequency of occurrences. Most histograms use one width of column to represent a category, while the vertical axis represents the frequency of occurrence.

A variation on the histogram is a frequency distribution chart invented by economist Vilfredo Pareto known as a ***Pareto chart***, in which the columns are arranged in decreasing order with the most common on the left and a line added that shows the cumulative total. The combination of columns and a line allows the user to tell at a glance which problems are most frequent and what fraction of the total they represent.

Planning and Control Results

The quality plan is produced during the **initiation phase**. The methods, procedures, and logic are described to demonstrate a commitment to a project of high **quality**. The plan identifies the products or services that will be measured and how they will be measured and compared to benchmarks. A flowchart demonstrates the logic and pathways to improve the plan.

During the **execution phase**, data are collected by measuring **samples** according to the design specified in the plan. The data are charted and analyzed. If variations are due to assignable causes, change requests are created.

KEY TAKEAWAYS

- Statistical control terms that are commonly used are tolerance (the range between **control limits**), flowchart (a diagram showing decision branches and loops), **benchmarking** (comparison to best practices), fishbone diagram (shows possible causes of quality problems), check sheet (form used to record frequency of problem occurrences), histogram (column chart that shows frequency of problems), and Pareto chart (histogram sorted by frequency from highest to smallest with a line that shows total cumulative problems).
- The quality planning process uses initial scope, budget, and schedule estimates to identify areas that need quality management.
- Control of **quality** in repetitive processes use statistical control methods that involve designing testing while considering the cost of quality, taking measurements, and then analyzing the data using run charts that show **control limits** and trends. Methodologies are compared to the best practices by competitors, which is called **benchmarking**. Errors are

documented using check sheets and analyzed using fishbone diagrams, histograms, or Pareto charts.

- The products of planning and controlling **quality** are a quality management plan, data, analysis documents, and proposals for improvement

10.5 Assuring Quality

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the purpose and methods of quality assurance.

The purpose of quality assurance is to create confidence that the quality plan and controls are working properly. To assure **quality**, time must be allocated to review the original quality plan and compare that plan to how **quality** is being ensured during the execution of the project.

Process Analysis

The flowcharts of **quality** processes are compared to the processes followed during actual operations. If the plan was not followed, the process is analyzed and corrective action taken. The corrective action could be to educate the people involved on how to follow the quality plan or to revise the plan.

The experiments that sample products and processes and collect data are examined to see if they are following statistically valid sampling techniques and that the measurement methods have small enough **tolerances** to detect variation within **control limits**.

Because projects are temporary, there are fewer opportunities to learn and improve within one project if it has a short **duration**, but even in short projects, the quality manager should have a way to learn from experience and change the process for the next project of a similar complexity profile.

Analyzing Quality Processes in Safety Training

The technical college responsible for training employees in safe plant practices evaluates its instructor selection process at the end of the training to see if it had the best criteria for selection. For example, it required the instructors to have Masters degrees in manufacturing to qualify as college instructors. The college used an exit survey of the students to ask what they thought would improve the instruction of future classes on this topic. Some students felt that it would be more important to require that the instructors have more years of training experience, while others recommended that the college seek certification as a training center by the Occupational Safety and Health Administration (OSHA).[1] The college considered these suggestions and decided to retain its requirement of a Master's degree but add a requirement that the instructor be certified by OSHA in plant safety.

KEY TAKEAWAYS

- The purpose of quality assurance is to build confidence in the client that **quality** standards and procedures are being followed. This is done by an internal review of the plan, testing, and revisions policies or by an audit of the same items performed by an external group or agency.

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[1] Occupational Safety and Health Administration, OSHA Training Institute Education Center Fact Sheet, July 3, 2007, http://www.osha.gov/fso/ote/training/edcenters/fact_sheet.html(accessed August 7, 2009).

CHAPTER 11

11 Managing Project Risk

11.0 Overview

Visit Audio Recordings for the audio version of this section.

This chapter aligns with chapter 11 of the PMBOK and 11% of the CAPM questions come from this knowledge area. The content connects to the Planning and Monitoring & Controlling category of the PMP questions.

All projects, including those within instructional design, rarely, if ever, go completely according to plan. Thus, competent project managers are prepared to deal with unexpected adversity during the course of the project. In order to mitigate the impact of disruptions, project managers must identify the potential risks and make appropriate plans. Failure to do so can easily lead to a decrease in project quality or unnecessary increases in budget.

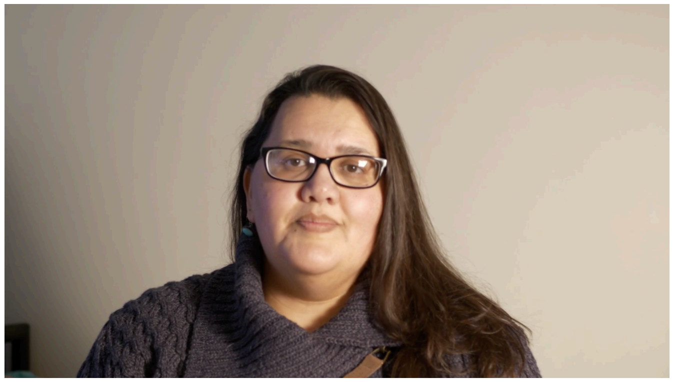
Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=217

Risk Management is a part of any project you do. A lot of risk management can be anticipated at the beginning of a project, or a lot of risk can be managed or at least contained at the beginning of the project by not over promising. It's important that clients get a very clear understanding of what you can't do, in addition to what you can. Click here to access transcript

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan



So projects don't always go as planned. You know, sometimes they may take a lot longer than you had intended, you might have multiple subject matter experts that end up working on the course to take it through to completion. Click here to access transcript.

Dr. Andy Gibbons – Instructional Psychology and Technology – BYU

At the beginning of this project we were training helicopter pilots, we were training sensor operators who sit at the back and operate electronic equipment. What was the biggest threat? It was probably me and my naivety. I was the project director of a project that eventually accumulated twenty-five staff members, and we were working with Navy teams of subject matter experts. We probably had eight or nine subject matter experts assigned to our project. That was a rich, rich resource. And I had no idea, I'd not been trained how to manage a project that size. My previous project experience had been a staff of four people at most: a secretary, an artist and a writer, and myself. Well this project was a different kind of challenge. The biggest risk was me not understanding, and as a result, there were some big mistakes made. I would say that as far as designer's secrets, that I should have known that I didn't know, it would be how subject matter experts, excuse me, how bodies of subject matter are organized. And how, as a designer, you have to be able to get to the heart of the subject matter quickly and efficiently, sometimes even before the subject matter expert is there. I'll tell you about another project. I was working on a project with DC-10 pilots, for a major airline. And we were doing a task analysis. Tried to identify all the tasks that these pilots had to be able to perform. We got to the part where we were talking about emergencies that they had to be able to perform. And we were listing emergencies that happened in the pilot's handbook. And I was all the time going through trying to make sure, are we leaving anything out? Is there anything that could go wrong with this aircraft that a pilot would have to be able to respond to, that needs to go into this task analysis? And they said, well no. I said, well okay, hydraulic systems, your aircraft' s got two hydraulic systems. And they said, yeah. And I said, well what if both hydraulic systems, we've got a single hydraulic system failure here, and you got a procedure that the pilot has to learn for that. What about if you have a dual hydraulic system failure? What if both of them go out at the same time? Oh it never happens. If one of them goes out, the second one kicks in, it automatically turns itself on, you don't have to do anything. I said, hasn't there been any instance or isn't there some possibility of that happening. No, no, no. So we left it out of the task analysis. Not nine months later there was a DC-10 flying over Saint Louis somewhere in the region, mid U.S, and a private plane clipped off its tail. And both hydraulic systems failed. And there were three hundred people on board. Now, a quick thinking pilot figured out a way, I mean what happens when a hydraulic system fails on a major airliner, you can't control the aircraft, you can't turn it, you can't bank it you can't do anything. So how did they land that aircraft, they finally did land the aircraft, it was a crash landing, but it was a landing, and half of the people on board survived, so 150 people survived that crash landing in a cornfield. How did the pilot figure out how to handle that emergency? Well, they used the jet throttles. They would adjust it this way if they wanted to turn this way, they would adjust it this way if they wanted to turn this way. And so they were able to land the aircraft where they wanted to. And of course, they did altitude control just by denying gas to the engines. So they brought it down and a hundred and fifty people were saved, that otherwise would have died. But I always remembered that one time when I had the instinct to say I think I know your subject matter better than you do, and I think this is something that could happen. This is a task that you ought to include in your training. I'll just bet you it's in the training now. And so, you have to, as an instructional designer, you can't just be naive. You can't just accept what they tell you. You've got to question everything. You've got to become a big critic.

Heather Bryce – Independent Studies – BYU

I didn't know how expensive Art 45 was going to be. And I hate bringing that up over and over again, because honestly it was the only drawback of this project. Everything else went so well. That was probably a risk. Fortunately, you know, we had the funds to be able to pay for that. But some places, you know, you don't have the funds. If you run out of money, you are not able to finish your project. So that was probably a huge risk to this project. But other than that, there weren't really any risks. I mean I suppose there could have been conflict between the artist's opinions of what you should do when you have several artists working on different projects. But we just really didn't have that.

Dr. Larry Seawright – Center for Teaching and Learning – BYU

Probably in building the learning management system, that we call the BYU Learning Suite, the biggest risk that we had was the short beta test period that we're going to have. Had we known that up front I think we would have compressed some of our development cycle sooner so that we have a little bit more of a beta test period.

11.1 Defining Risk

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Define **project risk**.
2. Define the difference between known and **unknown risks**.
3. Describe the difference between the business risk of the organization and **project risk**.

Risk is the possibility of loss or injury.[1] ***Project risk*** is an uncertain event or condition that, if it occurs, has an effect on at least one project objective.[2] ***Risk management*** focuses on identifying and assessing the risks to the project and managing those risks to minimize the impact on the project. There are no risk-free projects because there are an infinite number of events that can have a negative effect on the project. **Risk management** is not about eliminating risk but about identifying, assessing, and managing risk.

Tzvi Raz, Aaron Shenhar, and Dov Dvir[3] studied **risk management** practices on one hundred projects in a variety of industries. The results of this study suggested the following about **risk management** practices:

- **Risk management** is not widely used.
- The projects that were most likely to have a **risk management** plan were those that were perceived to be high risk.
- When **risk management** practices were applied to projects, they appeared to be positively related to the success of the project.
- The **risk management** approach influenced project schedules and cost goals but exerted less influence on project product quality.
- Good **risk management** increases the likelihood of a successful project.

Risk deals with the uncertainty of events that could affect the project. Some potential negative project events have a high likelihood of occurring on specific projects. Examples are as follows:

- Safety risks are common on construction projects.
- Changes in the value of local currency during a project affect purchasing power and budgets on projects with large international components.
- Projects that depend on good weather, such as road construction or coastal projects, face risk of delays due to exceptionally wet or windy weather.

These are examples of **known risks**. ***Known risks*** are events that have been identified and analyzed for which advanced planning is possible. Other risks are unknown or unforeseen.

Weather

Project team members were flying to a project review meeting in Iqaluit when a severe storm caused all flights to be cancelled. Members of the leadership team could not make the meeting and weren't even able to return to their home base for a couple of days.

Sudden Family Death

Just before a project meeting in Calgary, the instructional design lead received word that his father had died in the middle of the night. The team delayed making decisions on some critical events without the knowledge and judgment of the instructional designer.

These events were unforeseen by the project team, and in both cases the projects experienced schedule delays and additional costs.

Project risks are separate from the ***organizational risks*** that are associated with the business purpose of the project.

A project was chartered to design training for a new customer management system at a cost not to exceed $250,000. If a project is completed on time, within budget, and meets all quality specifications, the project is successful. If the customer management system does not meet the needs of the organization, the organizational goals of the project may not be achieved. The customer management system is an organizational or business risk. The company authorized the project based on assumptions about the system meeting their needs. The system's capability is not a project risk on this project.

KEY TAKEAWAYS

- **Project risk** is the possibility that project events will not occur as planned or that unplanned events will occur that will have a negative impact on the project.
- Known risks can be identified before they occur, while **unknown risks** are unforeseen.
- **Organizational risks** are associated with the business purpose of the project and assumed by the client when deciding to do the project.

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[1] Merriam-Webster Online, s.v. "risk," http://www.merriam-webster.com/dictionary/Risk(accessed August 21, 2009).

[2] Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008), 273.

[3] Tzvi Raz, Aaron J. Shenhar, and Dov Dvir, "Risk Management, Project Success, and Technological Uncertainty," R&D Management 32 (2002): 101–12.

11.2 Risk Management Process

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify the major elements in managing **project risk**.
2. Describe the processes for identifying **project risk**.
3. Describe the processes for evaluating **risk**.
4. Describe the processes for mitigating **risk**.

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 **risk** and the evaluation of the potential impact of the risk. A***risk mitigation plan*** is designed to eliminate or minimize the impact of the ***risk events*** —occurrences that have a negative impact on the project. Identifying **risk** is both a creative and a disciplined process. The creative process includes brainstorming sessions where the team is asked to create a list of everything that could go wrong. All ideas are welcome at this stage with the evaluation of the ideas coming later.

Risk *Identification*

A more disciplined process involves using checklists of potential risks and evaluating the likelihood that those events might happen on 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 both specific risks on the checklist and expanding the thinking of the team. The past experience of the project team, project experience within the company, and experts in the industry can be valuable resources for identifying potential **risk** on a project.

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

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

The people category can be subdivided into risks associated with the people. Examples of people risks include the **risk** of not finding the skills needed to execute the project or the sudden unavailability of key people on the project. David Hillson[1] uses the same framework as the **work breakdown structure** (WBS) for developing 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.

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 Figure 11.1.

Figure 11.1 **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 ethnic food
		Dion or Carlita have special food allergies or preferences
	Develop and distribute schedule	Printer out of toner
		Out of paper
	Make hotel arrangements in Calgary	City hotels full due to major event
		Lost reservation

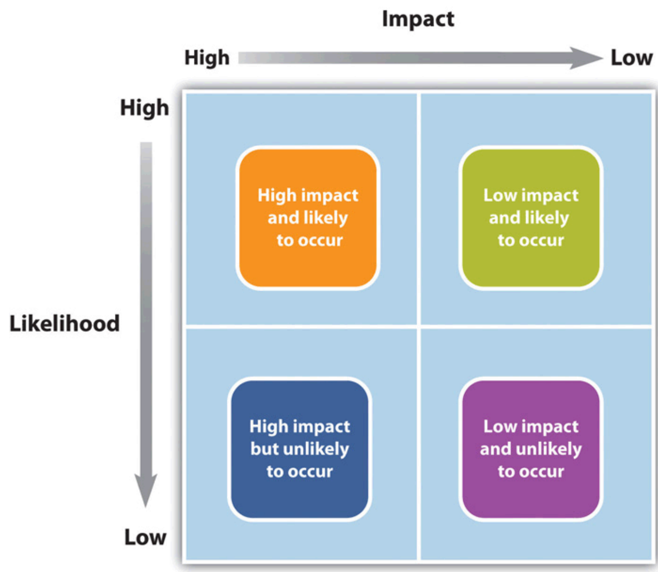
The result is a clearer understanding of where risks are most concentrated. Hillson's approach helps the project team identify **known risks**, but can be restrictive and less creative in identifying **unknown risks** and risks not easily found inside the **work breakdown structure**.

Risk Evaluation

After the potential risks have been identified, the project team then evaluates the **risk** based on the probability that the **risk event** will occur and the potential loss associated with the event. Not all **risks** are equal. Some **risk events** are more likely to happen than others, and the cost of a **risk event** can vary greatly. Evaluating the **risk** for 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 are those that could increase the project costs by 5% of the conceptual budget or 2% of the detailed budget. Only a few potential **risk events** met these criteria. These are the critical few 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. These become the critical few.

Figure 11.2 **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 assure 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 the identification of the risks, each **risk event** is analyzed to determine the likelihood of occurring and the potential cost if it did occur. The likelihood and impact are both rated as high, medium, or low. A **risk mitigation plan** addresses the items that have high ratings on both factors—likelihood and impact.

Risk Analysis of Equipment Delivery

A project team analyzed the **risk** of some important equipment not arriving to the project on time. The team identified three pieces of equipment that were critical to the project and would significantly increase the costs of the project 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 with a high impact. The other two pieces of equipment were potentially a high impact on the project but with a low probability of occurring.

Not all project managers conduct a formal **risk assessment** on the project. One reason, as found by David Parker and Alison Mobey[2] in their phenomenological study of project managers, was a low understanding of the tools and benefits of a structured analysis of **project risks**. 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 will 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 that may be 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 with greater complexity, the process for evaluating **risk** is more formal with a **risk assessment** meeting or series of meetings during the life of the project to assess risks at different phases of the project. 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 execution plan.

On 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 reflect that there is 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.

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 the following 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 the **risk** activities. Many organizations that work on international projects will reduce political, legal, labor, and others **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 expertise and experience the project team does not have. If the **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** 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. A project manager may hire an expert to review the technical plans or the cost estimate on a project to increase the confidence in that plan and reduce the **project risk**. Assigning highly skilled project personnel to manage the 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 labor strikes are examples of events that can significantly impact the project and that are outside the control of the project team.

Contingency Plan

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. These plans are called contingency plans. The **risk** of a truck drivers' 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, will manage contingency funds at the project level, with approval of the project manager required before contingency funds can be used.

KEY TAKEAWAYS

- **Risk management** is a creative process that involves identifying, evaluating, and mitigating the impact of the **risk event**.
- **Risk management** can be very formal, with defined work processes, or informal, with no defined processes or methods. Formal **risk evaluation** includes the use of checklists, brainstorming, and expert input. A **risk breakdown structure (RBS)** can follow the **work breakdown structure** (WBS) to identify **risk** by activity.
- **Risk evaluation** prioritizes the identified risks by the likelihood and the potential impact if the event happens.
- **Risk mitigation** is the development and deployment of a plan to avoid, transfer, share, and reduce **project risk**. Contingency planning is the development of alternative plans to respond to the occurrence of a **risk event**.

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[1] David Hillson, "Using a Risk Breakdown Structure in Project Management," Journal of Facilities Management 2, no. 1 (2003): 85–97.

[2] David Parker and Alison Mobey, "Action Research to Explore Perceptions of Risk in Project Management," International Journal of Productivity and Performance Management 53, no. 1 (2004): 18–32.

11.3 Project Risk by Phases

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the elements of **risk management** during the **initiation phase**.
2. Describe the elements of **risk management** during the **planning phase**.
3. Describe the elements of **risk management** during the **execution phase**.
4. Describe the elements of **risk management** during the **closeout phase**.

Image by shawncalhoun

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

INITIATION PHASE

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.

Risks by Phase in John's Move

In the **initiation phase** of John's move, John considers the **risk** of events that could affect the whole 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 Vancouver to Saskatoon 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 is 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 for their consideration in his recent interviews.
2. John checks the market in Saskatoon 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 Vancouver to Saskatoon using an Internet mapping service and gets an estimate of 16.5 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 high-impact risks can be mitigated and the costs from the mitigation would be acceptable in order to get a new job.

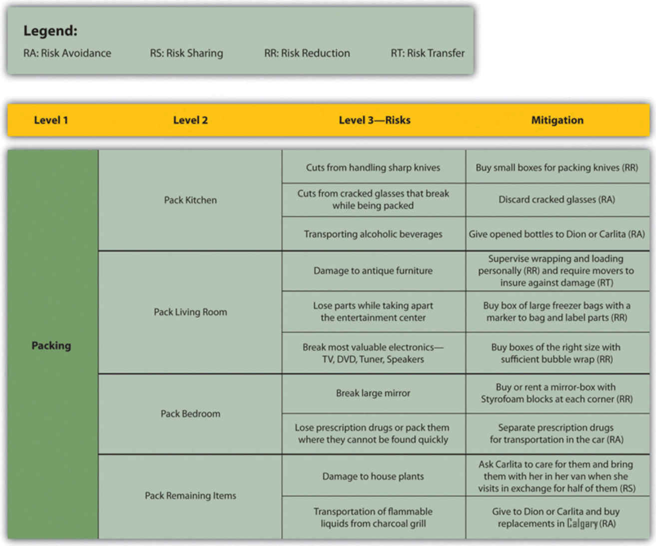
PLANNING PHASE

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.

***Risk Breakdown Structure** for John's Move*

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 Figure 11.3.

Figure 11.3 **Risk Breakdown Structure (RBS)** for Packing John's Apartment



Legend:
RA: Risk Avoidance RS: Risk Sharing RR: Risk Reduction RT: Risk Transfer

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 glasses (RA)
		Transporting alcoholic beverages	Give opened 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 center	Buy 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	Break large mirror	Buy or rent a mirror-box with Styrofoam blocks at each corner (RR)
		Lose prescription drugs or pack them where they cannot be found quickly	Separate prescription drugs for transportation in the car (RA)
	Pack Remaining Items	Damage to house plants	Ask Carlita to care for them and bring them with her in her van when she visits in exchange for half of them (RS)
		Transportation of flammable liquids from charcoal grill	Give to Dion or Carlita and buy replacements in Calgary (RA)

EXECUTION 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 checked off that are related to activities that have been performed.

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** examined to be sure 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 was done, the result can be compared to the predicted result.

Risk Closeout on John's Move

To close out the **risk mitigation plan** for John's move, John examines the **risk breakdown structure** and **risk mitigation plan** for items that need to be finalized. He makes a checklist to be sure all the **risk mitigation plans** are completed, as shown in Figure 11.4.

Figure 11.4 Closeout of **Risk Mitigation Plan** for John's Move

Risk	Mitigation	Closeout
Items lost by movers	Mover's insurance plus digital image inventory	Confirm all of the numbered boxes are present and still sealed
Antique furniture damaged	Mover's insurance plus personal supervision of wrapping and loading	Supervise unloading and unwrapping; visually inspect each piece
House plants	Ask Carlita to bring half of them in her van when she visits	Confirm that the plants are healthy and that Carlita brought about half of them

Risk is not allocated evenly over the life of the project. On projects with a high degree of new technology, the majority of the risks may be in the early phases of the project. On projects with a large equipment budget, the largest amount of **risk** may be during the procurement of the equipment. On global projects with a large amount of political risk, the highest portion of risk may be toward the end of the project.

KEY TAKEAWAYS

- During the **initiation phase**, risks are identified that could threaten the viability of the project. Mitigation options are considered to see if they would be sufficient to protect the project.
- During the **planning phase**, risks are identified and analyzed for each activity group in a **risk breakdown structure**, and mitigation is planned for each risk
- During the **execution phase**, risks are checked off as activities are completed or mitigation is performed if loss does occur. New risks are identified and added to the plan.
- During the **closeout phase**, insurance contracts are cancelled and partnerships terminated. A summary of actual costs associated with risks are compared with initial estimates to refine estimating capabilities. The successes and failures of the **risk management** plan are summarized and saved with the project documentation to add to the company's corporate knowledge.

11.4 Project Risk and the Project Complexity Profile

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Identify the relationship between project **risk** and external, internal, technical, and environmental complexity.

Image by Michigan Municipal League (MML)

Risk seems to have a **positive correlation** to complexity. High-risk projects are in most cases highly complex. The process of conducting a risk analysis focuses on understanding what can go wrong and the likelihood that it will go wrong. The project team then develops a project mitigation plan that addresses the items that were identified as high risk. The complexity analysis explores the project from the perspective of what elements on the project add to project complexity. The result of this analysis is the information needed by the project leadership to develop an appropriate execution plan. This execution plan also contains the **risk management** plan.

Although increased complexity on a project increases the project risk profile, **risk** is only one component of the complexity profile, and the manageability of the **risk** is also reflected in the complexity level of the project. For example, the organizational component of the project may be extremely complex with decision making shared among several independent clients. The project management team will develop an execution plan that includes developing and maintaining alignment among the various clients. Although the organizational **risk** of the project decreases with the development of the execution plan, the organizational approach of the client did not change the complexity level of the project. If the **Darnall-Preston Complexity Index (DPCI)** is used to rate the project, high ratings in each category carry their own types of increased risks.

External Complexity

Projects that have a high score in the external complexity category in the DPCI are larger and longer than usual for the project management group and the project manager and the available resources are lacking. Due to lack of experience on this size project, **unknown risks** are significant. The inadequacy of resources will cause risks that are more predictable.

Internal Complexity

Projects with high scores for internal complexity have risks to the budget, schedule, and quality due to organizational complexity and changes of scope due to lack of clarity in project and scope statements.

Technological Complexity

High scores in technological complexity are associated with high levels of **risk** due to unknown flaws in the technology and lack of familiarity with it. These problems result in risks to the schedule, budget, and quality.

Environmental Complexity

Environmental complexity includes legal, cultural, political, and ecological factors. High scores for complexity in this category imply high risks for delay and expensive resolution to lawsuits, public opposition, changes for political considerations, and unforeseen ecological impacts.

KEY TAKEAWAYS

- There is a **positive correlation** between the complexity of a project and the risk. Increased levels of complexity imply more people, newer technologies, and increased internal and external unknown factors.
- High scores for external complexity imply high risks to the schedule, budget, and quality due to unknown factors and limited resources.
- High scores for internal complexity imply high risks to the budget, schedule, and quality due to organizational complexity and changes of scope due to lack of clarity in project and scope statements.
- High scores for technological complexity imply high risks to the budget, schedule, and quality due to unknown flaws in the technology and lack of familiarity with it.
- Environmental complexity includes legal, cultural, political, and ecological issues. High scores for complexity in this category imply high risks for delay and expensive resolution to lawsuits, public opposition, changes for political considerations, and unforeseen ecological impacts.

CHAPTER 12

12 Project Closure

12.0 Overview

Visit Audio Recordings for the audio version of this section.
This chapter aligns with chapter 3 of the PMBOK. 11% of the CAPM questions come from this knowledge area. The content connects to the Closure category of the PMP questions.

This chapter describes several of the essential close-out activities to be performed at the end of a project.

Designers Share Their Experiences

Dr. Rick Schwier – Emeritus Professor, Educational Technology and Design – University of Saskatchewan

A YouTube element has been excluded from this version of the text. You can view it online here: https://openpress.usask.ca/pm4id/?p=234

Yeah, generally speaking, when we have major projects that come out of these, we will meet with the client and everyone. We call a huge gathering. We gather the clan, we get all the instructional designers together. We get all of the clients and stakeholders together, all the people who've been involved. We have them invite significant others. And we roll out the product. We demonstrate the product, we usually do two reports. Click here to access transcript

Kristine Dreaver-Charles – Instructional Designer, Distance Education Unit – University of Saskatchewan

It's always nice to be able to get to the completion of an online course and to be able to go for coffee or meet up for lunch with the subject matter expert and really celebrate and acknowledge the work that's gone on in order to complete that course development. Click here to access transcript.

The most interesting part of scaling back a project toward the end is, actually it's the funnest part of the project because there are a lot of celebrations as people are dropping off the payroll you have a party for them, and you have a close-out, and there are gifts that are given to each other, and it's fun. And people who are on your staff use their talents to celebrate each other. We had one, oh just this amazing artist on this one helicopter pilot project I did. And he drew a big caricature of the whole team. And gave out caricatures of the team members to each one of them. It was a wonderful thing, and I still have a poster that is about this big, in colorful color, the nicest artwork you want to see. The caricature of everybody that is on the team and they all signed it. It's just a warm memory. And one of the things that you want to do at the end of the project is make sure that you've given the people on your project the best possible experience. As a manager, you're not just a dollar and cents person, you're not just a timetable person. You're a leader and you need to be an inspiring leader. And you need to, by the time they finish the project, they need to have seen you as a leader, they need to have learned something, the project needs to have enriched their experience, they need to have gained friendships, they need to be working as a team. If you can't get there, then the project gets done, but as a designer you haven't done your job.

Heather Bryce – Independent Studies – BYU

I think the biggest challenge in finishing a project is keeping people engaged. When you've worked on a project for a long time, maybe at the beginning of a project you had a more important role than you might as your role kind of becomes less in one project as you move onto another, I think it's hard to stay engaged in that former project. As your roles, you might have to do a few edits, come back and fix a few things that you worked on, but you might have moved on. So I think that's the biggest challenge is, people who have moved on to a more important role in project B, it's harder to get them back to "Hey don't forget about the things you need to finish up to get project A. So I think the most important process that we have is the course completion process. It goes through a lot of different hands and it's those final touches that you have to put on to have a course go live. And while the tasks themselves are kind of small, they add up. So a course could be delayed up to two weeks, because people just sit on their tasks. You know, "oh it's just a five minute task". But if everybody sits on a five minute task for a couple of days the time adds up quickly. So I think as the project manager you need to make sure that people continue to be engaged even when their role lessens, and to make sure you finish up strong.

Dr. Larry Seawright – Center for Teaching and Learning – BYU

With the BYU Learning Suite, which is an ongoing project, there is never a close-out or something like that. Until the University decides, okay we're going to shift from using our own internally developed learning management system, and we'll go back out on the market and once more buy a more commercially available one. At that point then we'll go through the close-out process, and take a look at things. But, that being said, you still have, no matter how you officially close out a project, there is a delivery. We're going to start delivery on December 1st this year. Faculty, it will be available to them to begin to build courses. So that's really the close out period at that point were going to have post-mortem meetings. We'll take a look at what went well, what didn't go well? What can we learn that we can apply to the ongoing enhancement process, because this is an ongoing project. Things that we can do better, places that we can involve the faculty more, so that there's more faculty buy-in. Places where we can involve students more, so students are more appreciative of it, and understand it better. Quite frankly, become demanding of faculty, you know, you must use the Learning Suite because it makes our lives so easy, kind of thing. That's how the Learning Suite will succeed. Ultimately, in any project, it's the end users and whether or not they like it that will determine its success. They like it and start buying it or accessing it or downloading it, you know, whatever the method of delivery is, or the method of purchase is, then it's a success. And you know, you can take a look those things and say, you know, this was good, these things were not quite so good, but there has to be some point where you just kind of stick a stake in the ground and say let's take some time and look at what worked, what didn't work and what lessons can we learn from that. And that's kind of difficult sometimes. It's actually the classic evaluation problem. A lot of evaluation never gets done because it takes time, it takes money, and it's never used. You know, once the evaluation is done, people don't make use of it, same with a project management post-mortem. If you don't take the time and the money to do it, you won't get useful data that is usable and actionable for making changes. So you don't want to just go through and have a post-mortem because it's part of the project management checklist. You want to do it if people are going to use it. Otherwise just skip it and, you know, go on with the project.

12.1 Project Closure

Visit Audio Recordings for the audio version of this section.

LEARNING OBJECTIVES

1. Describe the procedures for closing out contracts.
2. Describe the elements and purpose of the post-project review process.
3. Identify the types of documents that should be archived.
4. Identify the objectives of the project closeout celebration.

Team members who were excited by the project in its early stages may find it difficult to maintain their focus to complete the project. They might already be looking forward to the next project. Bringing a project to an end requires a different management style that focuses on details as well as an analysis of the decisions that were made.

CLOSING OUT CONTRACTS

The last stage of the project procurement cycle includes the payment of the bills and closing of procurement contracts. **Suppliers** provide commodities that should meet standards of **quality**. The project team must check the records of deliveries made and determine that they were acceptable **quality**. If any items were rejected for poor **quality** or not delivered, the final payment is adjusted accordingly.

Punch Lists and Performance Tests

If a vendor is providing a service or building something for the project, there are usually items that must be fixed or mistakes that must be corrected before the contract is complete. On a software project, performance tests are run on the software, usually by the people who will be using the software, and any performance expectations not met are noted. Sometimes the expectations were not captured in the **project scope** of work and sometimes the performance did not meet the expectations established in the scope. If the items were not in the scope of work and the owner wants the work done, then the owner typically issues a change order. If the expectations were in the scope of work, the contractor is still responsible for completing the work.

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/or team/manager that still remain to be done. The project team will then work on all of the items on the 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 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 the **punch list**.

Transfer to Customer or Sponsor

If the product of the project is a software system, or something that must be operated and maintained by someone else, it must be turned over to the people who will be responsible for it after the project is complete. They might perform their own inspection to determine if the project team has met its goals for **quality** and that all elements of the project are complete. These performance tests are typically identified in the original project contract.

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 between the supplier and the project.

Post-project Evaluations

Before the team is dissolved and begins to focus on the next project, a review is conducted to capture the lessons that can be learned from this project, often called a ***lessons learned meeting*** or document. The team explores what went well and captures the processes to understand why they went well. The team asks if the process is transferable to other projects. The team also explores what did not go well and what people learned from the experience. The process is not to find blame, but to learn.

Quality management is a process of continual improvement that includes learning from past projects and making changes to improve the next project. This process is documented as evidence that quality management practices are in use. Some organizations have formal processes for changing work processes and integrating the lessons learned from the project so other projects can benefit. Some organizations are less formal in the approach and expect individuals to learn from the experience and take the experience to their next project and share what they learned with others in a very informal way. Whatever type of approach is used, the following elements should be evaluated and the results of the post-project evaluations are summarized in reports for external and internal use.

Project Profile

One of the first activities was to create a project profile to determine where the challenges were most likely to occur. If the **Darnall-Preston Complexity Index (DPCI)** was used, each of the complexity evaluations is reviewed and compared to actual events that occurred during the project. The team explores the changes in the complexity level during the life of the project and how the team managed the complexity during the life of the project. Learning from this exercise develops expertise that is useful in making the next project profile. The DPCI rating is adjusted, if necessary, for reference purposes on future projects.

Trust and Alignment Effectiveness

The project leadership reviews the effect of trust—or lack of trust—on the project and the effectiveness of alignment meetings at building trust. The team determines which problems might have been foreseen and mitigated and which ones could not have been reasonably predicted. What were the cues that were missed by the team that indicated a problem was emerging? What could the team have done to better predict and prevent trust issues?

Schedule and Budget Management

The original schedule of activities and the network diagram are compared to the actual schedule of events. Events that caused changes to the schedule are reviewed to see how the use of **contingency reserves** and float mitigated the disruption caused by those events. The original estimates of **contingency time** are reviewed to determine if they were adequate and if the estimates of **duration** and float were accurate. These activities are necessary for the project team to develop expertise in estimating schedule elements in future projects—they are not used to place blame.

A review of budget estimates for the cost of work scheduled is compared to the actual costs. If the estimates are frequently different from the actual costs, the choice of estimating method is reviewed.

Risk Mitigation

After the project is finished, the estimates of risk can be reviewed and compared to the events that actually took place. Did events occur that were unforeseen? What cues existed that may have allowed the team to predict these events? Was the project contingency sufficient to cover unforeseen risks? Even if nothing went wrong on this project, it is not proof that **risk mitigation** was a waste of money, but it is useful to compare the cost of avoiding risk versus the cost of unexpected events to understand how much it cost to avoid risk.

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.

Customer Satisfaction

Relationships with the client are reviewed and decisions about including the client in project decisions and alignment meetings are discussed. The client is given the opportunity to express satisfaction and identify areas in which to improve. Often a senior manager from the organization interviews the client to develop feedback on the project team performance.

A general report that provides an overview of the project is created to provide **stakeholders** with a summary of the project. The report includes the original goals and objectives and statements that show how the project met those goals and objectives. Performance on the schedule and budget are summarized and an assessment of client satisfaction is provided. A version of this report can be provided to the client as a stakeholder and as another means for deriving feedback.

Senior Management

The report to senior management contains all the information provided to the **stakeholders** in a short executive summary. The report identifies practices and processes that could be improved or lessons that were learned that could be useful on future projects.

Document Archival

The documents associated with the project must be stored in a safe location where they can be retrieved for future reference. Signed contracts or other documents that might be used in tax reviews or lawsuits must be stored. Organizations will have legal document storage and retrieval policies that apply to project documents and must be followed. Some project documents can be stored electronically.

Care should be taken to store documents in a form that can be recovered easily. If the documents are stored electronically, standard naming conventions should be used so documents can be sorted and grouped by name. If documents are stored in paper form, the expiration date of the documents should be determined so they can be destroyed at some point in the future. The following are documents that are typically archived:

- Charter documents
- Scope statement
- Original budget
- Change documents
- DPCI ratings
- Manager’s summary—lessons learned
- Final DPCI rating

PROJECT CELEBRATION

Image by Jason Pratt

A final celebration is a symbolic ending of a project and perhaps the dissolution of the team. The end of a major project is often a time to reflect. Project team members and **stakeholders** have typically invested a great deal of time and emotional energy into the success of the project. Because of this investment and because of the close relationships that develop during a project, project closure is often sad. However, it is also an opportunity to improve client and team-member satisfaction.

Reviewing the challenges and successes of the project creates a positive memory of the project and reinforces the learning that can be transferred to future projects. Awards or recognition plaques might be given out to individuals who made an outstanding contribution to the project. Groups or teams can be recognized for instances where trust between team members made a positive difference can be rewarded. Celebrating the successes of the project provides a sense of accomplishment and closure that brings satisfaction and pride in a job well done.

KEY TAKEAWAYS

- To close contracts, systems are tested, materials are inspected, and **punch lists** of work to be completed are made.
- The purpose of the post-project review is to examine decisions that were made with partial knowledge with the way the project actually developed to learn from the experience and to improve future decisions. It is also used to identify processes that can be improved.
- Original project documents, such as the charter, scope statement, and budget, are stored. Documents developed during the project, such as change agreements, are stored. Post-project reviews, including a summary of lessons learned and a final project profile description—DPCI rating—are saved.
- At the project closeout celebration, positive behavior is awarded for individuals, and groups and the client or sponsor is invited to speak to enforce a sense of satisfaction.

Appendix for Transcripts

Glossary

68-95-99.7

For normal distributions, about 68.3% of the measurements fall within one 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%.
10.1

Actual cost (AC)

The sum of the amounts actually spent on the items.
1.4 9.2 9.5 11.3 12.1

Alignment process

Developing a common understanding among the key stakeholders of the purpose and goals of the project and the means and methods of accomplishing those goals.
7.4

Analogous estimate

An estimate that is based on other project estimates.
9.1

Assignable cause

Variations in quality that can be tracked and fixed
10.2

Asynchronous communications

Communications that take place when the parties are not present at the same time. Examples are e-mail and blogs.
6.1

Atarimae hinshitsu

Make things work the way they are supposed to work
10.2

Atarimaie hinshitsu

A Japanese quality management term that describes making things work the way they should.
10.2

Attributes

The characteristics and identifiers of an activity.
8.2

Benchmarking

Comparing your organization's product or process to a standard of quality or industry best practice.
10.4

Beta-test

A trial of a product in its final stages of development.

4.3

Bias

The making of decisions based on a prejudged perspective.
8.2

Bid

A quote that lists the specific materials to be provided, the price for each, and a schedule for delivery.
9.4

Bins

subdivisions of measured values.
10.1

Blog

An online journal that can be private, shared by invitation, or made available to the world.

Bottom-up estimating

Project schedule as a hierarchy where the general descriptions of tasks are at the top and the lower levels become more detailed, finding the price of each item at the lowest level and then summing them to determine the cost of higher levels
9.1

Budget at Completion (BAC)

The estimate to complete is the difference between the original budget for the entire project.
9.2

Budgeted cost of work performed (BCWP)

Budgeted cost of work scheduled that has been done.
9.2

Budgeted cost of work scheduled (BCWS)

Comprises the detailed cost estimates for each activity in the project.
9.2

Cash flow

Movement of the project's money.
7.1

Central limit theorem

If several random factors are affecting the process, they tend to offset each other, yielding the most common results near the middle of the range.
10.1

Chance cause

Variations in quality caused by random events.
10.2

Change management process

A process that incorporates a change into the project planning and execution processes.
2.3 4.3 5.1 9.5

Chartering organization

The organization that determines the need for the project
7.0

Check sheet

A form on which the user can track each time a problem occurs.
10.4

Closeout phase

Includes transferring staff, archiving documents, closing offices, completing punch list tasks, and turning over the results of the project to the client. PMI calls this phase "closing of the project."
3.1

Cloud services

A blanket term that describes a range of web-based software that uses the internet as its communication framework.
6.2

Commodities

Common products that are purchased based on the lowest bid.
9.0

Communication matrix

A list of reports, meetings, and document flowcharts that details who is included in each project meeting and the distribution of major documents in a table format.
7.5

Complex adaptive systems

consist of a large number of parts or activities that interact with each other in numerous and various ways. A complex adaptive system is adaptive if the activities adjust or react to the events of the environment. Successful adaptive systems adjust in a way that facilitates or allows the system or project to achieve its purpose.
2.3

Complex systems

Complex systems have multiple interacting components whose collective behavior cannot be simply inferred from the behavior of the individual components.
2.3

Conceptual estimate

Also known as "ballpark estimate", it is developed with the least amount of knowledge. The major input into the conceptual estimate is expert knowledge or past experience.
1.4

Contingency planning

Development of alternative plans to respond to the occurrence of a risk event.
11.2

Contingency reserves

Money is budgeted for dealing with unplanned but statistically predictable cost increases.
9.2

Contingency time

If the project is behind schedule, the time can be made up by dropping activities.
8.4

Contract

An agreement between the organization and an outside provider of a service or materials.
9.5

Contracting plan

The contract plan defines the relationship between the project and the subcontractors (supplier, vendor, or partner) and also defines a process for making changes in the agreement to accommodate changes that will occur on the project.
9.5

Control chart

A document that tracks sample measurements collected over time while a process is running (also known as a run chart).
10.2

Control limits

The upper and lower extremes of allowable variation.
10.1

Cost aggregation

Process of subtotaling coasts by category or activity.
9.1

Cost of quality (COQ)

The difference between the additional money spent on prevention and the corresponding reduction in the cost of failure.
10.2

Cost Performance Index (CPI)

The ratio of the earned value to the actual cost.
9.2

cost variance (CV)

The difference between the earned value and the actual cost.

Cost- reimbursable contract / cost-plus contracts

The organization agrees to pay the contractor for the cost of performing the service or providing the goods.
9.5

Crashing the schedule

describes the techniques used to shorten the project schedule.
8.4

Critical path

The path through the network that results in the latest completion date of the project.
8.3

Culture

Reflects the community's assumptions, norms, values, and artifacts.
2.4

Current schedule

A schedule update is distributed regularly to provide project stakeholders with an assessment of the progress of the project against the master schedule while providing new start and end dates for all activities and the project.
8.4

Darnall-Preston Complexity Index (DPCI™)

The Darnall-Preston Complexity Index (DPCI™) is designed to develop a project profile that reflects different aspects of the project that will influence the approach to leading and executing the project.
2.4

Dependency

The relationship between a predecessor activity and a successor activity.
8.2

Detailed estimate

After a project design is more complete, a project detailed estimate can be developed. When the project team knows the number of rooms, the type of materials, and the building location of a home, the project team can provide a detailed estimate. A detailed estimate is not a bid.
1.4

Deterministic system

A system that will produce the same results if you start with the same conditions. The outcome can be reliably predicted if you know the starting conditions.
2.3

Duration

How long will the project take to accomplish from beginning to end.
8.2

Early start dates (ES)

The earliest date the activity can begin.
8.3

Earned value (EV)

Sum the budgeted cost of work performed at a specified point in the project schedule.
9.2

Earned value management (EVM)

A method of periodically comparing the budgeted costs with the actual costs during the project.
9.2

Ecology

The science of ecology studies interactions between individual organisms and their environments, including interactions with both conspecifics and members of other species.
https://plato.stanford.edu/entries/ecology/
2.4

Emotional Intelligence

Emotional Intelligence - The ability to sense, understand, and effectively apply emotions as human energy.
5.1

Emotional Intelligence Quotient

Emotional Intelligence Quotient (EQ) - The ability to use, understand, and manage your emotions in positive ways.
5.1

Estimate

An educated guess based on knowledge, experience, and inference.
8.2

Estimate to Complete (ETC)

The manager evaluates the accuracy of the cost estimates for the activities that have taken place and uses that experience to predict how much money it will take to complete the unfinished activities of the project.
9.2

Execution phase

Includes the major activities needed to accomplish the work of the project. PMI calls this phase “carrying out the work.”
3.1

Extensible markup language (XML)

a set of rules that allows for content marked by tags to be read. The data can be imported into a spreadsheet or database for analysis.
6.2

External attributes

The relative size of the project, duration of the project, and the available resources.
2.4

Finish-finish relationship

Activities can start at different times but they must finish at the same time.
8.2

Finish-start relationship

Activities that have predecessor-successor relationships occur sequentially—one after the other.
8.2

Fishbone diagram

A drawing that represents cause and effect to determine a quality problem
10.4

Fixed-price contract

A legal agreement between the project organization and an entity (person or company) to provide goods or services to the project at an agreed-on price.
9.5

Fixed-price contract with price adjustment

Used for unusually long projects that span years.

9.5

Fixed-price with incentive fee

A contract type that provides an incentive for performing on the project above the established baseline in the contract.
9.5

Fixed-total-cost contract

If the service provider is responsible for incorporating all costs, including profit, into the agreed-on price.
9.5

Fixed-unit price contract

If the service or materials can be measured in standard units, but the amount needed is not known accurately, the price per unit can be fixed.
9.5

Float

The amount of time an activity, network path, or project can be delayed from the early start without changing the completion date of the project.
8.3

Flowchart

A diagram that uses standard symbols to display a process that has branches or loops.
10.4

Free float

Activities that are not on the critical path have a different between their early start date and their late start date, those activities can be delayed without affecting the project completion date.
8.3

Frequency distribution

How many measurements fall into each established category.
10.1

Functional managers

Functional managers and team focus on the technology of the project. On a training project, the functional manager would include the professional trainers; on an information technology project, the software development managers would be functional managers.
1.4

Gantt chart

A type of bar chart used to illustrate activity relationships in a project. The Gantt chart was developed by Henry Gantt and used on major projects, including building the Hoover Dam and the U.S. interstate highway system.2 The Gantt chart is a time-scaled graphic that represents each activity with a bar that reflects the duration, start, and finish time.

Goal

An end toward which effort is directed.
7.1

Histogram

A type of frequency distribution chart.

10.4

Humm Factor

A qualitative survey tool designed to capture the thoughts of the project participants.
5.2

Inference

The process of deriving conclusions based on assumptions.
8.2

Initiation phase

Includes activities such as holding alignment and kickoff meetings, identifying the project team, developing the resources needed to develop the project plan, and identifying and acquiring the project management infrastructure. PMI calls this phase the "starting the project."
3.1

Intelligent numbering

Breaking the activity into smaller units and listing the tasks needed to accomplish that step.
8.2

Interest

A percentage of the amount of the loan that has not been repaid.
7.1

Internal attributes

The clarity of a project's scope, the complexity of the organization, and the agreement among stakeholders.
2.4

Internal Rate of Return (IRR)

A method used if the project involves buying and installing equipment to make a profit.
7.1

Kaizen

A Japanese quality management term that describes participation by all.
10.2

Kansei

A Japanese quality management term that describes learning from the way the client uses the product to make improvements.
10.2

Key Supplier

A relationship with one or two suppliers based on developing cost savings for both organizations.
9.4

Known risks

Events that have been identified and analyzed for which advance planning is possible.
11.1

Lag time

An account of time must go by before a successor activity can begin.
8.2

Lead time

The successor activity can overlap the end of its predecessor activity and begin before the predecessor is finished.
8.2

Lesson learned meeting

a review meeting conducted to capture lessons that can be learned from the project, and how those lessons can be transferred and applied to future projects.
12.1

Long lead items

Items that take a long time to acquire.
9.6

Management reserves

Money can be made available at the manager's discretion to meet needs that would change the scope of the project.
9.2

Mean

Central point in a distribution of items affected by random factors, represented by the Greek letter mu, μ
10.1

Milestone schedule

Establishes key dates throughout the life of a project that must be met for the project to finish on time.
1.4

Milestones

Significant events in a project which consume no resources and have no duration.
8.2

Miryokuteki hinshitsu

A Japanese quality management term that describes giving products an aesthetic quality to make them pleasing to use.
10.2

Myers-Briggs Type Indicator

Myers-Briggs Type Indicator - A tool used for identifying how people perceive the world and make decisions.
5.1

Natural dependency

The successor activity starts after and is dependent on the predecessor activity.
8.2

Negative float

The calculated completion date of the last activity is later than the targeted completion date established at the beginning of the project.
8.3

Nonlinear system (chaotic system)

can produce wildly different results even if the starting conditions are almost exactly the same.
2.3

Normal distribution

If a distribution of items is charted, and the factors that cause variation are random, the chart will resemble the shape of a bell.
10.1

Objective

A measurable outcome.
7.1

Official rules

The rules of the project that are stated.
5.3

Openly-licensed

Open Licenses are a set of conditions applied to an original work that grant permission for anyone to make use of that work as long as they follow the conditions of the license. A work refers to an original creation, such as a video, song, document, or piece of software, that can be copyright protected.
https://www.yearofopen.org/what-are-open-licenses/
2.4

Operational rules

The official rules that are enforced.
5.3

Operations manager

A manager whose primary focus is to efficiently and effectively achieve the purpose of the organization.
1.3

Organizational risks

Risks associated with the business purpose of the project.
11.1

Outsourcing

Procure work from outside companies.
9.3

Parameters

Measurable factors that can be used in an equation.
9.1

Parametric estimates

Estimates that are calculated by multiplying measured parameters by cost-per-unit values
9.1

Partnership

A formal arrangement to execute the project with each party contributing resources.
9.4

Phase

A phase represents a grouping of similar activities that has a very loosely defined beginning and end.
3.1

Planned value (PV)

Amount of work that should have been done by a particular date.
9.2

Planning phase

includes developing detailed staffing, procurement, and project controls plans. PMI calls this phase “organizing and preparing.”
3.1

Positive correlation

When measurable items both increase or decrease together.
11.2

positive correlation

Precedence diagram method (PDM)

A technique for graphically displaying the logic of the schedule by placing the activities in boxes with arrows between them to show the precedence-successor relationships. This type of diagram is also called a project network diagram.
8.2

Proactive

Planning in advance of a potential risk
11.2

Process managers

managers who have expertise in estimating, cost tracking, planning, and scheduling.
1.4

Procurement

The process of obtaining goods and services from providers who are outside of the organization.
9.0

Programmers

Programmers will specify the performance requirements of the equipment, and suppliers that have equipment that meets the requirements will bid on the project.
3.2

Progress payments

Payments made before the end of the project and based on the progress of the work.
9.5

Project

PMI defines a project by its two key characteristics: it is temporary and undertaken to create a product, service, or result that is unique. Projects are undertaken by various organizations to better fulfill their purposes.

1.2

Project control

Project controls is both the planning function and the function that tracks progress against the plan.

3.2

Project culture

The shared norms, beliefs, values, and assumptions of the project team.

5.3

Project environment

The project environment includes all the issues related to the environment that will influence the development and execution of the project plan.

2.4

Project Execution Plan

How the work will be accomplished.

2.0

Project logic

The development of the activity sequence or determining the order in which the activities will be completed.

8.2

Project logic diagram

Represents the logical sequence of the activities needed to complete the project.

1.4

Project management

"The application of knowledge, skills, tools, and techniques to project activities to meet the project requirements."1

Project management offices (PMOs)

Facilitate development of organizational knowledge, skills, and tools to internally charter and manage projects.

Project manager

A manager whose primary focus is on the goals of the project.

1.3

Project network diagram

A technique for graphically displaying the logic of the schedule by placing the activities in boxes with arrows between them to show the precedence-successor relationships. This type of diagram is also called a precedence diagram method (PDM).

Project Profiling

the process of extracting a characterization from the known attributes of a project.

2.1

Project quality

Project quality focuses on the end product or service deliverables that reflect the purpose of the project.
1.4

Project quality plan

The project manager is responsible for developing a project quality plan that defines the quality expectations and assures that the specifications and expectations are met.
1.4

Project risk

An uncertain event or condition that may occur and negatively affect the project
11.1

Project scope

Defines what is inside the project and what is outside.
7.2

Project sponsor

The project sponsor is outside the day-to-day operations of the project and has the organizational authority to provide resources and overcome barriers for the project.
3.2

Punch list

a list of all the items found by the client/or team/manager.
3.1

Purpose statement

Provides a project with an anchor or organizational focus.
7.4

Qualified

Meet standards of reliability and capability.
9.1

Quality

How well something meets the expected or specified requirements of its grade.
10.1

Quality Control (QC)

The management of production standards through statistical interpretation of random product measurements, which emphasizes consistency and accuracy.
10.2

Reactive

Responding to problems or unexpected events when they occur.
11.2

Reconciliation

The process of matching the schedule of transfers with the schedule of activity payments.

9.1

Relationship dependence

a key aspect of complex adaptive systems, characterized by the dependence of the project on the activities, the interdependence of the activities, and the specialization of the activities.
2.3

Request for proposal (RFP)

Describes the work, service, or product to be provided by the vendor and the quality level required.
9.1

Request for quote (RFQ)

A list of materials and supplies is developed and provided to the suppliers.
9.4

Resource calendar

A calendar that indicates which days they are available and which are days off to consider the availability of team members, consultants, and vendors.
8.2

Resource leveling

Managing the schedule of activities to ensure that enough resources are available to complete each task by distributing the workload.
8.4

Resources

Time, materials, facilities, and equipment needed to accomplish the project.
8.2

Responsibility Matrix

A table of people and types of problems that might require decisions.
4.3

Risk

the possibility of loss or injury.
1.4

Risk assessment

includes both the identification of potential risk and the evaluation of the potential impact of the risk.
11.2

Risk averse

Avoid taking risks whenever possible
11.2

Risk avoidance

Developing an alternative strategy that has a higher probability of success but usually at a higher cost.
11.2

Risk breakdown structure (RBS)

A way of organizing identified risks into categories using a table format.
11.2

Risk evaluation

Prioritizing risks by the likelihood and potential impact.
11.2

Risk events

Occurrences that have a negative impact on the project.
11.2

Risk management

Identifying and assessing the risks to the project and managing those risks to minimize their impact.
11.1

Risk mitigation

Development and deployment of a plan to avoid, transfer, share, and reduce project risk
11.2

Risk mitigation plan

A plan designed to eliminate or minimize the impact of risk events.
11.2

Risk reduction

Actions or investment of funds to reduce the risk on a project
11.2

Risk sharing

Partnering with others to share responsibility for risk.
11.2

Risk transfer

A risk reduction method that shifts the risk from the project to another party
11.2

Rough order of magnitude (ROM)

an estimate taking into account information needed for development.
1.4

Samples

Randomly selected subsets from the total population.
10.1

Scaled

To match the size and complexity of the current project or by applying standardized formulas.
9.1

Schedule Performance Index (SPI)

The ratio of earned value to planned value gives an indication of how much of the project is completed.
9.2

Scope change log

A record that should be kept to track changes.
7.2

Scope creep

the incremental expansion in the project scope.
1.4

Scope of work (SOW)

typically a written document that defines what work will be accomplished by the end of the project—the deliverables of the project.
1.4

Self-performed

Project team members perform the work.
9.3

Simple payback

if the purpose of the project is to improve cash flow—make it more positive or less negative—the improved positive cash flow each year is applied to the original cost (negative cash flow) of the project to determine how many years it would take to pay back the original cost.
7.1

Six Sigma (6σ)

Quality management practices based on continuous efforts at improvement involving everyone at the company.
10.2

Slack (float)

If the critical path takes less time than is allowed by the client to complete the project, the project has a positive total float or project slack. If the client's project completion date precedes the calculated critical path end date, the project has negative float.
8.3

Solicitation

The process of requesting a price and supporting information from bidders.
9.6

Span of control

The span of control represents the number of people reporting to a manager.
3.2

Stakeholders

those who have a share or interest in the organization.
1.2

Standard deviation

The calculated amount of difference of the measurements from the central value.
10.1

Start-start relationship

When two or more project activities occur at the same time or concurrently.
8.2

Statistics

The mathematical interpretation of numerical data.
10.1

Suppliers

Providers of commodities.
9.4

Synchronous communications

communications that take place when all the parties are present at the same time. Examples are telephone calls and video conferencing.
6.1

Tags

characters inserted on either side of a particular section or a form or document that assign a data label.
6.2

Technical management

The technical management on the project is the management of the technology inherent in the project—not the technology used by the team to manage the project.
3.2

Time & materials contract (T&M)

The contractor might charge an hourly rate for labor, plus the cost of materials, plus a percentage of the total costs.
9.5

Tolerances

The control limits of variations in quality
10.4

Total float

The difference between the finish date of the last activity on the critical path and the project completion date.
8.3

Total quality management (TQM)

A flexible program that is adapted from Japanese practices
10.2

typology

A classification or profile of projects that is reflected in two dimensions.
1.5

UCC filings

Standardized financial disclosure documents that conform to the uniform commercial code.
9.6

Unknown risks (unforeseen risks)

Events that have not been identified and for which there is no advance planning.
11.1

Variance

The difference between planned and actual progress.
9.2

Vendors

Provide a unique product or service that cannot be readily purchased in the marketplace and typically provides a product or service that is designed for the project.
9.4

Version control

labeling each revision, which enables the team to understand the latest activity and status of the document (or the activity behind the document).
2.2

Virtual teams

teams that use electronic methods of communicating without face-to-face meetings.
1.4

Work breakdown structure

a list of activities, including estimates of their durations, their relationships with others, and the resources assigned to them.
1.4

Work breakdown structure (WBS)

A list of activities, including estimates of their durations, their relationships with others, and the resources assigned to them.
8.2

Future Recommendations

PM4ID, the First Canadian Edition, offers new features and improvements to the original textbook, including:

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New cover design, updated fonts, and enhanced list of Glossary terms.
- Addition of four new case studies, written to deepen reader comprehension.
- Inclusion of images with diverse skin tones, body shapes, abilities, and gender to increase representation.
- Revised content to feature Canadian spelling and contexts.
- Overall review of all written material in the textbook with detailed notes documenting content revisions.
- Comprehensive revisions based on peer reviews collected by the Open Textbook Library.
- Significant revisions to Chapter 6, with major updates to content on communication and scheduling (project management) software focusing on web-based solutions.
- Multiple versions of the book, including PDF, EPUB, HTML, MOBI, and all chapters are available in natural voice audio recordings.
- A series of video cases with interviews of Canadian instructional design experts (video and audio recordings).
- Interactive reviews of three chapters using H5P activities.

Recommendations for Future Editors

Alignment of writing style and formatting consistency

It is challenging to ensure that the writing style is consistent throughout the textbook with a diverse team of contributors. We feel that aligning the writing style and ensuring uniformity of tables and charts are worthwhile tasks for a future team.

Accessibility functionality

A significant portion of our revisions focussed on increased accessibility features, including additions to the glossary, a text hover feature, and updated chapter audio recordings. Future editors should know that increased accessibility features lead to multiple locations for some elements. For example, definitions within the text are also located in the glossary and hover text effect.

It is important to note that if our work is revised, the glossary, hover text, and chapter audio recordings will need to be updated to accommodate those changes. The text-to-speech (TTS) translation can also be updated as the technology improves.

Content accuracy and relevance

One challenge that we faced as a team was not being experts on the topic of project management. We believe that some textbook sections would benefit from a review by project management experts to determine accuracy and relevancy. For example, chapter six required major revisions, so other chapters may need significant modifications. Two sections where this might be true are 9.6 and 10.2.

Questions and key takeaways

If time permitted, we would have contributed additional questions and key takeaways with learning points for the reader to consider. Future editors may want to contribute additional questions and key takeaways to improve reader understanding.

Instructional design case studies and video interviews

Chapters that might benefit from case studies include chapters 5, 7, and 9. Additional video interviews from instructional design experts across Canada would contribute a broader representation of project management strategies and best practices.

Contact

If you or your class want to help improve the First Canadian Edition of *Project Management for Instructional Designers,* contact Paula MacDowell (paula.macdowell@usask.ca).