

The Systems Analyst and Information Systems Development

PLANNING

TASK CHECKLIST

- ☐ Identify project.
- ☐ Develop systems request.
- ☐ Analyze technical feasibility.
- ☐ Analyze economic feasibility.
- ☐ Analyze organizational feasibility.
- ☐ Perform project selection review.
- ☐ Manage scope.
- ☐ Staff project.
- ☐ Create project charter.
- ☐ Set up CASE repository.
- ☐ Develop standards.
- ☐ Begin documentation.
- ☐ Assess and manage risk.

This chapter introduces the role of the systems analyst in information systems development projects. First, the fundamental four-stage systems development life cycle (planning, analysis, design, and implementation) is established as the basic framework for the information system (IS) development process. Next, ways in which organizations identify and initiate potential projects are discussed. The first steps in the process are to identify a project that will deliver value to the business and to create a system request that provides the basic information about the proposed system. Next, the analysts perform a feasibility analysis to determine the technical, economic, and organizational feasibility of the system.

OBJECTIVES

- Explain the role played in IS development by the systems analyst.
- Describe the fundamental systems development life cycle and its four phases.
- Explain how organizations identify IS development projects.
- Explain the importance of linking the IS to business needs.
- Be able to create a system request.
- Describe technical, economic, and organizational feasibility assessment.
- Be able to perform a feasibility analysis.

Introduction

The **systems development life cycle (SDLC)** is the process of determining how an information system (IS) can support business needs, designing the system, building it, and delivering it to users.

If you have taken a programming class or have programmed on your own, you have probably experienced some success in developing small software applications. Creating high-quality IS that meet expectations and provide meaningful value to organizations is a much more complex endeavor, however.

Numerous studies over the years report that projects involving information technology experience failure rates from 30 to 70%.¹ The definition of failure in these studies is often quite different, so the meaning of these statistics is hard to pin down. It is clear, though, that bringing an IS development project to a successful conclusion is difficult and many things need to be done right if we hope to achieve a positive outcome.

Although we would like to promote this book as a “silver bullet” that will keep you from experiencing failed IS projects, we must admit that such a silver bullet guaranteeing IS development success does not exist.² Instead, this book will provide you with many fundamental concepts and practical techniques that you can use to improve the likelihood of success. We also discuss how the approach to systems development projects has evolved to improve the odds of project success.

The systems analyst plays a key role in the SDLC, analyzing the business situation, identifying opportunities for improvements, and designing an IS to implement the improvements. Many systems analysts view their profession as one of the most interesting, exciting, and challenging jobs around. As a systems analyst, you will work as a team with a variety of people, including business and technical experts. You will feel the satisfaction of seeing systems that you designed and developed make a significant positive business impact, while knowing that your unique skills helped make that happen.

It is important to remember that the primary objective of the systems analyst is not to create a wonderful system. The primary goal is to create value for the organization, which for most companies means increasing profits. (Government agencies and not-for-profit organizations measure value differently.) Many failed projects were abandoned because the analysts tried to build a wonderful system without clearly understanding how the system would support the organization’s goals, improve business processes, and integrate with other IS to provide value. An investment in an IS is like any other investment, such as a new machine tool. The goal is not to acquire the tool, because the tool is simply a means to an end; the goal is to enable the organization to perform work better so that it can earn greater profits or serve its constituents more effectively.

¹Michael Krigsman, “CIO Analysis: Why 37 Percent of Project Fail,” *znet.com*, accessed February 2014.

²The idea of using the silver bullet metaphor was first described in a paper by Frederick Brooks. See Frederick P. Brooks, Jr., “No Silver Bullet—Essence and Accident in Software Engineering,” *Information Processing 1986, the Proceedings of the IFIP Tenth World Computing Conference*, H.-J. Kugler (ed.), 1986: 1069–76.

This book introduces you to the fundamental skills needed by a systems analyst. This is a pragmatic book that discusses best practices in systems development; it does not present a general survey of systems development that exposes you to everything about the topic. Systems analysts *do things* and challenge the current way that an organization works. To get the most out of this book, you will need to actively apply the ideas and concepts in the examples and in the “Your Turn” exercises that are presented throughout to your own systems development project. This book will guide you through all the steps for delivering a successful IS. In the text, we illustrate how one organization, called DrönTeq, applies the steps in one project, developing a Web-based intermediary e-commerce system. By the time you finish the book, you will not be an expert systems analyst, but you will be ready to start building systems for real.

CONCEPTS IN ACTION 1-A

An Array of IT Failures

A significant proportion of IT projects fail to fulfill their original objectives, resulting in wasted resources and a damaged reputation for the responsible IT department. In many cases, the causes of the failure are organizational issues, not technical issues.

Qantas, the Australian national airline, has endured two high-profile IT failures in recent years. In 1995, Project eQ, a 10-year technology services contract with IBM, was canceled after four years, at a cost of \$200 million. Poor planning contributed to the failure to upgrade a complex and unwieldy IT infrastructure saddled with over 700 applications written in older programming languages.

In 2008, Qantas canceled Jetsmart, a \$40 million parts-management system implementation, due in part to a dispute with the unionized users (aircraft mechanics) of the system. The union advised its members not to assist with the implementation, claiming the software unnecessarily increased the members' workload.

An analysis of these IT failures reveals several contributing factors. First, Qantas faced the challenges of a complicated technical infrastructure and outdated legacy applications. More significantly, however, was the failure of company leadership to understand basic IT issues. In public statements, the company CFO seemed not to care about the user perspectives on new software, preferring instead to put in what management thought was appropriate. This attitude, in part, led to union problems and claims of poorly designed, hard-to-use software and inadequate training.

Aging applications and an unwieldy technical infrastructure are challenges faced by many organizations today. But the senior-management attitude that seemingly disregards the views of software users casts serious questions about Qantas' prospects for IT project success in the future.

Large systems development projects are particularly susceptible to failure. An example was a \$110 million unemployment compensation system upgrade project conducted by IBM for

the state of Pennsylvania that was never completed and ended in a lawsuit. When the project was ended in 2013, the project was 45 months behind schedule and \$60 million over budget.

An analysis of very large development projects conducted by the Standish Group found that for projects that exceed \$100 million in labor costs, only 2% are successful (defined as on time and under budget). Although many factors contributed to this specific project's flaws, several major factors were delays in decision making and a high workforce turnover during the project.

An 18-month long project to implement a SaaS customer relationship management system ultimately was declared a bust and scrapped. This project had top management support and was on time and on budget. So why was it considered a failure?

Although the project team believed it understood the project goals and the outcome that was expected, at the end of the project, the end users did not want the system. Users were distrustful of the new system and resistance to change was extremely high.

In this instance, technical issues did not contribute to project failure. The lack of collaboration between the system developers and the business users ultimately derailed this implementation project. The development team focused on project execution rather than building engagement and buy-in from the users of the system.

Adapted from: Michael Krigsman, “Qantas Airways: A Perfect Storm for IT Failures?”, February 29, 2008, zdnet.com, accessed March 2014.

Adapted from: Patrick Thibodeau, “Pennsylvania Sues IBM Over Troubled \$110M IT Upgrade,” *Computerworld.com*, March 13, 2017, <https://www.computerworld.com/article/3180325/pennsylvania-sues-ibm-over-troubled-110m-it-upgrade.html>, accessed February 2021.

Adapted from: Mary K. Pratt, “Why IT Projects Still Fail,” *CIO.com*, August 1, 2017, <https://www.cio.com/article/3211485/why-it-projects-still-fail.html?nsdr=true>, accessed August 2020.

In this chapter, we first describe the role of the systems analyst in IS development projects. We discuss the wide range of skills needed to be successful in this role, and we explain various specialties that systems analysts may develop. We then introduce the basic SDLC that IS projects follow. This life cycle is common to all projects and serves as a framework for understanding how IS projects are accomplished. We discuss how projects are identified and initiated within an organization and how they are initially described in a system request. Finally, we describe the feasibility analysis that is performed, which drives the decision whether to proceed with the project.

The Systems Analyst

The systems analyst plays a key role in IS development projects. The systems analyst works closely with all project team members so that the team develops the right system in an effective way. Systems analysts must understand how to apply technology to solve business problems. In addition, systems analysts may serve as *change agents* who identify the organizational improvements needed, design systems to implement those changes, and train and motivate others to use the systems.

Systems Analyst Skills

New IS introduce change to the organization and its people. Leading a successful organizational change effort is one of the most difficult jobs that someone can do. Understanding what to change, knowing how to change it, and convincing others of the need for change require a wide range of skills. These skills can be broken down into six major categories: technical, business, analytical, interpersonal, management, and ethical.

Analysts must have the technical skills to understand the organization's existing technical environment, the new system's technology foundation, and the way in which both can be fit into an integrated technical solution. Business skills are required to understand how IT can be applied to business processes and to ensure that IT delivers real business value. Analysts are continuous problem solvers at both the project and the organizational level, and they put their analytical skills to the test regularly.

Often, analysts need to communicate effectively, one-on-one with users and business managers (who often have little experience with technology), with programmers and other technical



SPOTLIGHT ON ETHICS - 1

James is a systems analyst on a new account management system for Hometown National Bank. At a recent meeting with the project sponsor, James learned about some new ideas for the system that were not a part of the original project scope. Specifically, the bank's marketing director has asked that some of the data that will be collected by the new system from customers who open new checking and savings accounts also be used as the basis of a marketing campaign for various loan products the bank offers.

James is uncomfortable with the request. He is not sure the bank has the right to use a person's data for purposes other than the original intent. Who "owns" this data, the bank that collected it as a part of a customer opening an account, or the customer who the data describes? Should James insist that the customers give authorization to use "their" data in this way? Or should he say nothing and ignore the issue? Is it necessary (or appropriate) for a systems analyst to be an ethical watchdog in a systems development project? Why or why not?

specialists (who often have more technical expertise than the analyst does), and with people from outsourcing firms and vendor organizations. They must be able to give presentations to large and small groups and to write reports. Not only do they need to have strong interpersonal abilities, but they also need to manage people with whom they work, and they must manage the pressure and risks associated with unclear situations.

Finally, analysts must deal fairly, honestly, and ethically with other project team members, managers, and system users. Analysts often deal with confidential information or information that, if shared with others, could cause harm (e.g., dissent among employees); it is important for analysts to maintain confidence and trust with all people.

Systems Analyst Roles

As organizations and technology have become more complex, most large organizations now build project teams that incorporate several analysts with different, but complementary roles. In smaller organizations, one person may play several of these roles. Here we briefly describe these roles and how they contribute to a systems development project.

The **systems analyst** role focuses on the IS issues surrounding the system. This person develops ideas and suggestions for ways that IT can support and improve business processes, helps design new business processes supported by IT, designs the new IS, and ensures that all IS standards are maintained. The systems analyst will have significant training and experience in analysis and design and in programming.

The **business analyst** role focuses on the business issues surrounding the system. This person helps to identify the business value that the system will create, develops ideas for improving the business processes, and helps design new business processes and policies. The business analyst will have business training and experience, plus knowledge of analysis and design.

The **requirements analyst** role focuses on eliciting the requirements from the stakeholders associated with the new system. As more organizations recognize the critical role that complete and accurate requirements play in the ultimate success of the system, this specialty has gradually evolved. Requirements analysts understand the business well, are excellent communicators, and are highly skilled in an array of requirements elicitation techniques (discussed in Chapter 3).

The **infrastructure analyst** role focuses on technical issues surrounding the ways the system will interact with the organization's technical infrastructure (hardware, software, networks, and databases). This person ensures that the new IS conforms to organizational standards and helps to identify infrastructure changes that will be needed to support the system. The infrastructure analyst will have significant training and experience in networking, database administration, and various hardware and software products. Over time, an experienced infrastructure analyst may assume the role of **software architect**, who takes a holistic view of the organization's entire IT environment and guides application design decisions within that context.

YOUR TURN 1-1

Being an Analyst

Suppose you set a goal to become an analyst after you graduate. What type of analyst would you most prefer to be? Why does this particular analyst role appeal to you? What type of courses should you take before you graduate? What type of summer job or internship should you seek?

Question

Develop a short plan that describes how you will prepare for your career as an analyst.

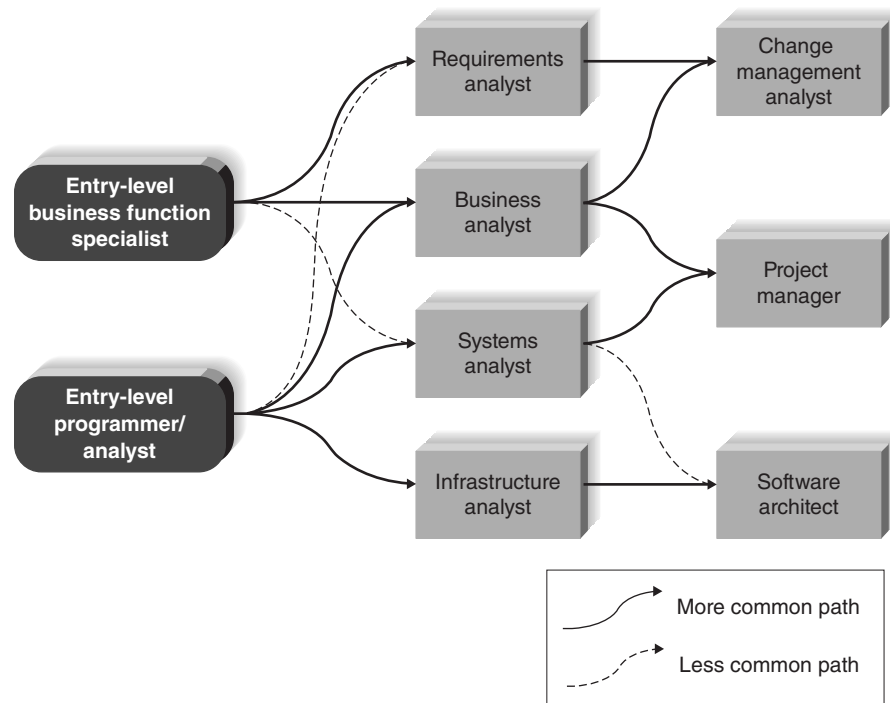


FIGURE 1-1 Career paths for system developers.

The **change management analyst** role focuses on the people and management issues surrounding the system installation. This person ensures that adequate documentation and support are available to users, provides user training on the new system, and develops strategies to overcome resistance to change. The change management analyst will have significant training and experience in organizational behavior and specific expertise in change management.

The **project manager** role ensures that the project is completed on time and within budget and that the system delivers the expected value to the organization. The project manager is often a seasoned systems analyst who, through training and experience, has acquired specialized project management knowledge and skills.

The roles and the names used to describe them may vary from organization to organization. In addition, there is no single typical career path through these professional roles. Some people may enter the field as a more technically oriented programmer/analyst. Others may enter as a business-oriented functional specialist with an interest in applying IT to solve business problems. As shown in Figure 1-1, those who are interested in the broad field of IS development may follow a variety of paths during their career.

The Systems Development Life Cycle

In some ways, building an IS is like building a house. First, the owner describes the vision for the house to the developer. Second, this idea is transformed into sketches and drawings that are shown to the owner and refined (often, through several drawings, each improving on the other) until the owner agrees that the pictures depict what he or she wants. Third, a set of detailed blueprints is developed that present much more detailed information about the house (e.g., the layout of rooms, placement of plumbing fixtures and electrical outlets). Finally, the house is built following the blueprints—and often with some changes and decisions made by the owner as the house is erected.

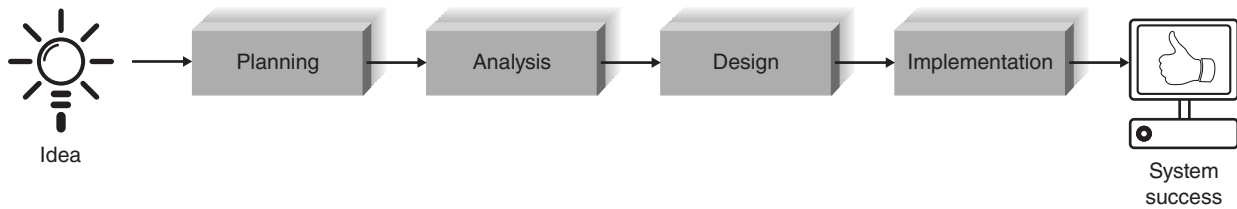


FIGURE 1-2 The systems development life cycle.

Building an IS using the SDLC follows a similar set of four fundamental **phases**: planning, analysis, design, and implementation (Figure 1-2). Each phase is itself composed of a series of **steps**, which rely on **techniques** that produce **deliverables** (specific documents and files that explain various elements of the system). Figure 1-3 provides more details on the steps, techniques, and deliverables that are included in each phase of the SDLC and outlines how these topics are covered in this textbook.

Figures 1-2 and 1-3 suggest that the SDLC phases proceed in a logical path from start to finish. In some projects, this is true. In many projects, however, the project team moves through

Phase	Chapter	Step	Technique	Deliverable
Planning Focus: Why build this system?	1	Identify opportunity	Project identification	System request
	1	Analyze feasibility	Technical feasibility Economic feasibility Organizational feasibility	Feasibility study
	2	Develop project plan	Scope management	Project plan
	How to structure the project? Primary outputs: —System request with feasibility study —Project plan			
	2	Staff project	Project staffing Project charter	—Staffing plan
	2	Control and direct project	CASE repository Standards Documentation Timeboxing Risk management	—Standards list —Risk assessment
Analysis Focus: Who, what, where, and when for this system?	3	Develop analysis strategy	Business process automation Business process improvement Business process reengineering	System proposal
	3	Determine business requirements	Interview JAD session Questionnaire Document analysis Observation	—Requirements definition
	Primary output —System proposal			
	4	Create use cases	Use case analysis	—Use cases
	4	Model processes	Data flow diagramming	—Process models
	5	Model data	Entity relationship modeling Normalization	—Data model
Design Focus: How will this system work?	6	Design physical system	Design strategy	Alternative matrix System specification
	7	Design architecture	Architecture design Hardware and software selection	—Architecture report —Hardware and software specification

FIGURE 1-3 Systems development life cycle phases.

Phase	Chapter	Step	Technique	Deliverable
Implementation Focus: Delivery and support of completed system Primary output: —Installed system	8	Design interface	Use scenario Interface structure Interface standards Interface prototype Interface evaluation	—Interface design
	9	Design programs	Data flow diagramming Program structure chart Program specification	—Physical process model —Program design
	10	Design databases and files	Data format selection Entity relationship modeling Denormalization Performance tuning Size estimation	—Database and file specification —Physical data model
	11	Construct system	Programming	Test plan
		Software testing	Programs	
		Performance testing	Documentation	
	12	Install system	Conversion strategy selection	Migration plan —Conversion plan —Business contingency plan —Training plan
	12	Maintain system	Training Support selection System maintenance Project assessment	Support plan Problem report Change request
	12	Postimplementation	Postimplementation audit	Postimplementation audit report

FIGURE 1-3 (Continued)

the steps consecutively, incrementally, iteratively, or in other patterns. Different projects may emphasize different parts of the SDLC or approach the SDLC phases in different ways, but all projects have elements of these four phases.

For now, there are two important points to understand about the SDLC. First, you should get a general sense of the phases and steps that IS projects move through and some of the techniques that produce certain deliverables. In this section, we provide an overview of the phases, steps, and some of the techniques that are used to accomplish the steps. Second, it is important to understand that the SDLC is a process of **gradual refinement**. The deliverables produced in the analysis phase provide a general idea of what the new system will do. These deliverables are used as input to the design phase, which then refines them to produce a set of deliverables that describes in much more detailed terms exactly how the system should be built. These deliverables in turn are used in the implementation phase to guide the creation of the actual system. Each phase refines and elaborates on the work done previously.

Planning

The **planning phase** is the fundamental process of understanding *why* an IS should be built and determining how the project team will go about building it. It has two steps:

1. During **project initiation**, the system's business value to the organization is identified—how will it contribute to the organization's future success? Most ideas for new systems come from outside the IS area and are recorded on a system request.

A **system request** presents a brief summary of a business need and explains how a system that addresses the need will create business value. The IS department works together with the person or department generating the request (called the **project sponsor**) to conduct a feasibility analysis. The **feasibility analysis** examines key aspects of the proposed project:

- The technical feasibility (Can we build it?)
- The economic feasibility (Will it provide business value?)
- The organizational feasibility (If we build it, will it be used?)

2. The system request and feasibility analysis are presented to an IS **approval committee** (sometimes called a **steering committee**), which decides whether the project should be undertaken.

Once the project is approved, it enters **project management**. During project management, the **project manager** creates a plan, staffs the project, and puts techniques in place to help control and direct the project through the entire SDLC. The deliverable for project management is a plan that describes how the project team will go about developing the system.

Analysis

The **analysis phase** answers the questions of *who* will use the system, *what* the system will do, and *where* and *when* it will be used (Figure 1-3). During this phase, the project team investigates any current system(s), identifies improvement opportunities, and develops a concept for the new system. This phase has three steps:

1. An **analysis strategy** is developed to guide the project team's efforts. Such a strategy usually includes studying the current system (called the **as-is system**) and its problems, and envisioning ways to design a new system (called the **to-be system**).
2. The next step is *requirements gathering* (e.g., through techniques such as interviews, group workshops, or questionnaires). The analysis of this information—in conjunction with input from the project sponsor and many other people—leads to the development of a concept for a new system. The system concept is explained through a set of *requirement statements* and a set of business **analysis models** that describe how the business will operate if the new system is developed. The analysis models represent user/system interactions and the data and processes needed to support the underlying business process.
3. The analyses, system concept, requirements, and models are combined into a document called the **system proposal**, which is presented to the project sponsor and other key decision makers (e.g., members of the approval committee) who will decide whether the project should continue to move forward.

The system proposal is the initial deliverable describing the requirements the new system should satisfy. Some experts suggest this phase would be better named *analysis and initial design*, rather than *analysis*, since it really provides the first step in the new system design. Since most organizations continue to use the name *analysis* for this phase, we will use it in this book as well. It is important to remember, however, that the deliverable from the analysis phase is both an analysis and a high-level initial design for the new system.

Design

The **design phase** decides *how* the system will operate in terms of the hardware, software, and network infrastructure that will be in place; the user interface, forms, and reports that will be used; and the specific programs, databases, and files that will be needed. Although most of the strategic decisions about the system are made in the development of the system concept during the analysis phase, the steps in the design phase determine exactly how the system will operate. The design phase has four steps:

1. The **design strategy** must be determined. This clarifies whether the system will be developed by the company's own programmers, whether its development will be outsourced to another firm (usually a consulting firm), or whether the company will buy and install a prewritten software package.
2. This leads to the development of the basic **architecture design** for the system that describes the hardware, software, and network infrastructure that will be used. In most cases, the system will add to or change the infrastructure that already exists in the organization. The **interface design** specifies how the users will move through the system (e.g., by navigation methods such as menus and on-screen buttons) and the forms and reports that the system will use.
3. The **database and file specifications** are developed. These define exactly what data will be stored and where they will be stored.
4. The analyst team develops the **program design**, which defines the programs that need to be written and exactly what each program will do.

This collection of deliverables (architecture design, interface design, database and file specifications, and program design) is the **system specification** that is used by the programming team for implementation. At the end of the design phase, the feasibility analysis and project plan are reexamined and revised, and another decision is made by the project sponsor and approval committee about whether to terminate the project or continue (Figure 1-3).

Implementation

The final phase in the SDLC is the **implementation phase**, during which the system is actually built (or purchased and installed if the design calls for a prewritten software package). This is the phase that usually gets the most attention, because for most systems it is the longest and most expensive single part of the development process. This phase has three steps:

1. System **construction** is the first step. The system is built and tested to ensure that it performs as designed. Since the cost of fixing bugs can be immense, testing is one of the most critical steps in implementation. Most organizations should spend more time and attention on testing than on writing the programs in the first place.
2. The system is installed. **Installation** is the process by which the old system is turned off and the new one is turned on. There are several approaches that may be used to convert from the old to the new system. One of the most important aspects of conversion is training, during which users are taught to use the new system and help manage the resulting organizational changes.
3. The analyst team establishes a **support plan** for the system. This plan usually includes a formal or informal postimplementation review, as well as a systematic way for identifying major and minor changes needed for the system.

Project Identification and Initiation

Where do project ideas come from? A project is identified when someone in the organization identifies a **business need** to build a system. Examples of business needs include supporting a new marketing campaign, reaching out to a new type of customer, or improving interactions with suppliers. Sometimes, needs arise from some kind of “pain” within the organization, such as a drop in market share, poor customer service levels, unacceptable product defect rates, or increased competition. New business initiatives and strategies may be created and a system to support them is required, or a merger or acquisition may require systems to be integrated.

Business needs also can surface when the organization identifies unique and competitive ways of using IT. Many organizations keep an eye on **emerging technology**, which is technology that is in the early stages of widespread business use. For example, if companies stay abreast of technological advances such as cloud computing, Big Data, or machine learning, they can develop business strategies that leverage the capabilities of these technologies and introduce them into the marketplace as a **first mover**. Ideally, companies can take advantage of this first mover position by making money and continuing to innovate while competitors trail behind.

Today, many new IS projects grow out of **business process management (BPM)** initiatives. BPM is a methodology used by organizations to continuously improve end-to-end business processes. BPM can be applied to internal organizational processes and to processes spanning multiple business partners. By studying and improving their underlying business processes, organizations can achieve several important benefits, including

- enhanced process agility, giving the organization the ability to adapt more rapidly and effectively to a changing business environment;
- improved process alignment with industry “best practices”; and
- increased process efficiencies as costs are identified and eliminated from process workflows.

BPM generally follows a continuous cycle of systematically creating, assessing, and altering business processes. Business analysts, with their in-depth business knowledge, play a particularly important role in BPM by

1. defining and mapping the steps in a business process;
2. creating ways to improve on steps in the process that add value;
3. finding ways to eliminate or consolidate steps in the process that do not add value;
4. creating or adjusting electronic workflows to match the improved process maps.

The last step is particularly relevant to our discussion since the need for IS projects is frequently identified here. In fact, the automation of business processes [termed **business process automation (BPA)**] is the foundation of many information technology systems. In these situations, technology components are used to complement or substitute for manual information management processes with the goal of gaining cost efficiencies.

BPM practitioners recognize, however, that it is not always advisable to just “pave the cow paths” by simply adding automation to speed up existing processes (step 4 above). In many situations, **business process improvement (BPI)** results from studying the business processes, creating new, redesigned processes to improve the process workflows, and/or utilizing new technologies enabling new process structures (steps 2, 3, and 4 above). For example, could a retail store’s checkout process be redesigned along the lines of the EZPass toll collection system on highways? Could customers check out and pay with their mobile devices while clerks simply review the contents of the customer’s shopping bag?

Projects with a goal of BPI make moderate changes to the organization's operations and can improve efficiency (i.e., doing things right) and improve effectiveness (i.e., doing the right things). These types of projects involve more risk than business process automation projects since more significant changes are made to the organization's operations.

BPM may also reveal the need for the complete revamping of the organization's business processes, termed **business process reengineering (BPR)**. BPR means changing the fundamental way in which the organization operates—"obliterating" the current way of doing business and making major changes to take advantage of new ideas and new technology. As you might expect, BPR projects involve substantial risk due to the significant organizational and operational changes that result. Top management support and careful management are critical in these fairly rare types of projects.

Both IT people (i.e., the IS experts) and business people (i.e., the subject matter experts) should work closely together to find ways for technology to support business needs. In this way, organizations can leverage the exciting technologies available while ensuring that projects are based upon real business objectives such as increasing sales, improving customer service, and decreasing operating expenses. Ultimately, IS need to affect the organization's bottom line (in a positive way!).

When a strong business need for an IS is recognized, often as a result of BPM, a person (or group) who has an interest in the system's success typically steps forward. We call this person (or group) the *project sponsor*. Often, the project sponsor develops the initial vision of the new system. The project sponsor works throughout the SDLC to make sure that the project is moving in the right direction from the perspective of the business and serves as the primary point of contact for the project team. Usually, the sponsor of the project is from a business function such as marketing, accounting, or finance; however, members of the IT area also can sponsor or cosponsor a project.

The size or scope of the project often determines the kind of sponsor who is involved. A small departmental system might be sponsored by a single manager; however, a large, organizational initiative might be sponsored by the entire senior management team and even the CEO. If a project is primarily technical in nature (e.g., improvements to the existing IT infrastructure or research into the viability of an emerging technology), then sponsorship from IT is appropriate. When projects have great importance to the business, yet are technically complex, joint sponsorship by both the business and IT functions may be necessary.

The business need drives the high-level **business requirements** for the system. Business requirements describe the capabilities the system will provide the organization so that the

CONCEPTS IN ACTION 1-B

BPI on the Farm

In the farming industry, grain is commonly loaded into large grain-hauling trucks by the driver parking under the grain bin, jumping out of the truck cab, signaling the grain bin operator to start filling, monitoring the fill level, signaling the bin operator to stop filling, jumping back into the truck cab, driving 3 feet forward, and repeating the cycle numerous times until the truck bed is full. This laborious process can be simplified by *digitizing* the process. Cameras and secure Wi-Fi can be installed on the grain bin. When a truck arrives, the driver can open an app on his smartphone from the truck cab. Through the app,

the driver can initiate, monitor, and control the filling process without a grain bin operator and without leaving the truck. This real-world example illustrates BPI, the redesign of a business process with the right application of information technology, providing significant efficiency gains.

Adapted from: Nicole Laskowski, "Crowdsourcing is the new cloud computing—Get with it, CIOs," *searchcio.techtarget.com*, accessed February 2014.

YOUR TURN 1-2**Implementing a Satellite Data Network**

A major retail store spent \$24 million dollars on a large, private satellite communication system that provides state-of-the-art voice, data, and video transmission between stores and regional headquarters. When an item gets sold, the scanner software updates the inventory system in real time. As a result, store transactions are passed on to regional and national headquarters instantly, which keeps inventory records up to date. One of the store's major competitors has an older system in which transactions are uploaded at the end of a business day. The first company feels that its method of instant communication and feedback allows it to react more quickly to changes in the market, giving the company a competitive advantage. For example, if an early winter snowstorm causes stores across

the upper Midwest to start selling high-end (and high-profit) snow throwers quite quickly, the company's nearest warehouse can prepare next-day shipments to maintain a good inventory balance, while the competitor may not move quite as quickly and thus lose out on such quick inventory turnover.

Questions

1. Do you think a \$24 million investment in a private satellite communication system could be justified by a cost-benefit analysis? Could this be done with a standard communication line (with encryption)?
2. How might the competitor attempt to close the "information gap" in this example?

business needs are met. These requirements need to be explained at a high level so that the approval committee and, ultimately, the project team understand what the business expects from the final product. Business requirements summarize the features the IS must include, such as the ability to collect customer orders online or the ability for suppliers to receive inventory status information as sales occur.

The project sponsor has the insights needed to determine the **business value** that will be gained from the system, in both tangible and intangible ways. **Tangible value** can be quantified and measured easily (e.g., 2% reduction in operating costs). **Intangible value** results from an intuitive belief that the system provides important, but hard-to-measure, benefits to the organization (e.g., improved customer service, a better competitive position).

Once the project sponsor identifies a project that meets an important business need and he or she can identify the business requirements and business value of the system, it is time to formally initiate the project. In most organizations, project initiation begins by preparing a *system request*.

System Request

A *system request* is a document that describes the business reasons for building a system and the value that the system is expected to provide. The project sponsor usually completes this form as part of a formal system project selection process within the organization. Most system requests include five elements: project sponsor, business need, business requirements, business value, and special issues (Figure 1-4). The *sponsor* describes the person who will serve as the primary contact for the project, and the *business need* presents the reasons prompting the project. The *business requirements* of the project refer to the business capabilities that the system must have, and the *business value* describes the benefits that the organization should expect from the system. **Special issues** are included on the document as a catchall category for other information that should be considered in assessing the project. For example, the project may need to be completed by a specific deadline. Any special circumstances that could affect the outcome of the project must be clearly identified.

The completed system request is submitted to the *approval committee* for consideration. This approval committee could be a company steering committee that meets regularly to make IS decisions, a senior executive who has control of organizational resources, or any other decision-making body that governs the use of business resources. The committee reviews the system request

Element	Description	Examples
Project Sponsor	The person who initiates the project and who serves as the primary point of contact for the project on the business side	Several members of the finance department Vice president of marketing CIO CEO
Business Need	The business-related reason(s) for initiating the system	Reach a new market segment Offer a capability to keep up with competitors Improve access to information Decrease product defects Streamline supply acquisition processes
Business Requirements	The new or enhanced business capabilities that the system will provide	Provide online access to information Capture customer demographic information Include product search capabilities Produce performance reports Enhance online user support
Business Value	The benefits that the system will create for the organization	3% increase in sales 1% increase in market share Reduction in headcount by 5 FTEs \$200,000 cost savings from decreased supply costs \$150,000 savings from removal of outdated technology
Special Issues or Constraints	Issues that pertain to the approval committee's decision	Government-mandated deadline for May 30 System needed in time for the Christmas holiday season Top-level security clearance needed by project team to work with data
FTE, full-time equivalent.		

FIGURE 1-4 Elements of the system request form.

and makes an initial determination, based on the information provided, of whether to investigate the proposed project or not. If approved, the next step is to conduct a feasibility analysis.

Applying the Concepts at DrōnTeq

Throughout the book, we will apply the concepts in each chapter to a fictitious company called DrōnTeq. In this section, we illustrate the creation of a system request.

CONCEPTS IN ACTION 1-C

Interview with Don Hallacy, President, Technology Services, Sprint Corporation

At Sprint, network projects originate from two vantage points—IT and the business units. IT projects usually address infrastructure and support needs. The business-unit projects typically begin after a business need is identified locally, and a business group informally collaborates with IT regarding how a solution can be delivered to meet customer expectations.

Once an idea is developed, a more formal request process begins, and an analysis team is assigned to investigate and validate the opportunity. This team includes members from the user community and IT, and they scope out at a high level what the project will do; create estimates for technology, training, and development costs; and create a business case. This business

case contains the economic value added and the net present value of the project.

Of course, not all projects undergo this rigorous process. The larger projects require more time to be allocated to the analysis team. It is important to remain flexible and not let the process consume the organization. At the beginning of each budgetary year, specific capital expenditures are allocated for operational improvements and maintenance. Moreover, this money is set aside to fund quick projects that deliver immediate value without going through the traditional approval process.

Don Hallacy

YOUR TURN 1-3**Too Much Paper, Part 1**

The South Dakota Department of Labor, Workers' Compensation division was sinking under a load of paper files. This state agency ascertains that employees are treated fairly when they are injured on the job. If a person (or company) called to see the status of an injury claim, the clerk would have to take a message, get the paper file, review the status, and call the person back. Files were stored in huge filing cabinets and were entered by year and case number (i.e., the 415th person injured in 2008 would be in a file numbered 08-415). Few callers knew the file number and would give their name and address and the date of injury. The clerk would look in a spiral notebook for the last name around the date that was given—and then find the file number to retrieve the folder. Some folders were small—possibly documenting a minor injury requiring

only a brief treatment period. Other folders could be very large, with numerous medical reports from several doctors verifying the extent of a serious injury and treatment (such as an arm amputation). A digital solution was suggested—reports could be submitted online via a secure website. Medical reports could be submitted electronically, either as a pdf file or as a faxed digital file. This solution would also mean that the clerk taking the phone call could query the database by the person's name and access the information in a matter of seconds.

Question

Begin a system request for this project. Focus on stating the business need and the business requirements for this project. What is the value of this system?

DrōnTeq is a fictitious technology company that develops numerous unmanned aerial vehicles, called drones, and drone technology for many purposes. DrōnTeq was established by two technology entrepreneurs, Eric Chen and Peter Lyons. The field of drone technology was evolving rapidly, and Eric and Peter quickly established DrōnTeq as a leading maker of commercial-grade drones with advanced sensors and imaging capabilities.

As a technology company, DrōnTeq invests heavily in research and development of its drone products. It also developed proprietary software capable of providing unique analyses of the data collected by the drone's onboard sensors. The Sales department focuses primarily on drone sales and marketing to government and commercial entities. A new Client Services business unit has been formed within DrōnTeq, focusing on outsourced drone services. Carmella Herrera was named director of the Client Services business unit.

Project Background

DrōnTeq is a technology company and utilizes IS in a variety of ways. The new Client Services unit requires specialized IS support, however, to allow clients to request and receive drone services. In the business model of new business unit, licensed drone pilots contract with DrōnTeq to fly a DrōnTeq drone when requested by a client that is near the drone pilot. The drone pilot uses a current model DrōnTeq drone, provided at a favorable lease rate, in return for providing prompt flight service when requested by a client. All client drone flight requests will be processed through DrōnTeq's website. Once a request is received, the request will be posted for all contracted drone pilots to see. Pilots will have a specific window of time in which to submit a bid to conduct the flight. An assignment algorithm will determine the "winning" bid after the bidding window closes and automatically notifies the pilots and the client of the results.

Many aspects of the Client Services business unit will require IS support, but the current focus is on the customer-facing aspects of receiving a client request for service and assigning the request to a contracted drone pilot. A project to create the required support for the new business unit has been proposed by Carmella Herrera.

System Request

At DrōnTeq, new IS projects are reviewed and approved by an IS project steering committee that meets quarterly. The committee has representatives from IS as well as from other major areas of

System Request—Client Services Project

Project Sponsor: Carmella Herrera, General Manager, Client Services Business Unit

Business Need: This project has been initiated to create the capability of clients requesting drone flight service and data analysis through the company website. The capability is an essential element in the business model of the newly formed Client Services business unit.

Business Requirements: Using this system from our company website, clients will be able to request specific drone flight services and data analysis. A request will be offered to any contracted DrōnTeq drone pilots in the vicinity, who can submit bids during the bidding window. Once the bidding window closes, the pilot with the “winning” bid will be assigned the request.

Business Value: The Client Services business unit has been formed to enable clients who do not have a need for actual drone ownership to receive drone flight service and data analysis promptly and cost effectively. As a new business unit, we must estimate additional revenue from two streams: additional drone pilots who contract with DrōnTeq and lease a drone; and clients who contract for specific drone flight service and data analysis.

Conservative estimates of tangible value to the business unit include:

- \$357,500 in revenue from new pilot contracts and drone leases
- \$565,000 in revenue from drone flight service and data analysis

Special Issues or Constraints: The capabilities described in the Business Requirements are essential to the business model for the Client Services Business Unit. This project is necessary for the new business unit's operations.

FIGURE 1-5 System request for DrōnTeq.

the business. Carmella's first step was to prepare a system request for the committee. Figure 1-5 shows the system request she prepared. The project sponsor is Carmella, and the business needs are to enable clients to request drone flight service and data analysis through the company website. Notice that the need does not focus on the technology associated with the project. The emphasis is on the business aspects: providing the means for clients to request drone flight service and data analysis and determining a drone pilot who will perform the service.

In the system request, the project sponsor focuses on describing his or her vision of the business requirements at a high level. Carmella has expressed a clear vision of how this system will affect the new unit at DrōnTeq: producing revenues from new drone pilot contracts and drone leases and enabling sales from clients requesting drone flight service and data analysis. Carmella recognized that this system will be essential in supporting the proposed business model of the new business unit.

The estimates of tangible value were difficult to develop since this venture is completely new to DrōnTeq. To prepare for this, Carmella had several of her staff members conduct surveys of commercial drone operators and several agribusiness interest groups (agricultural uses are a prime target for the Client Services business unit). The surveys also attempted to gauge the drone pilots' and potential clients' price sensitivity for these offerings.

From the survey results, Carmella and her staff developed a range of sales projections for the various revenue streams: a high-level estimate, a medium-level estimate, and low-level estimate. They also developed probability assessments for each of these outcomes, settling on a 25% likelihood for the high-level estimate, a 60% likelihood for the medium-level estimate, and a 15% likelihood for the low-level estimate. Based on the sales projections and the probability estimates, a weighted average estimated sales figure was computed for each revenue stream.

For example, for revenue from new pilot contracts and drone leases,

$$\begin{aligned}
 \text{Expected sales} &= (500,000 \times .25) + (350,000 \times .60) + (150,000 \times .15) \\
 &= 125,000 + 210,000 + 22,500 \\
 &= 357,500
 \end{aligned}$$

These projections are summarized in Figure 1-6.

After analyzing the survey results, Carmella and her staff were confident that the sales projections and probability estimates were as accurate as they could make them for this new business venture. The completed system request is shown in Figure 1-5.

	Revenue Projections	
	Pilot Contracts and Drone Leases	Client Requests for Drone Flight Service and Data Analysis
High-level estimate (prob. = 25%)	\$500,000	\$700,000
Medium-level estimate (prob. = 60%)	\$350,000	\$550,000
Low-level estimate (prob. = 15%)	\$150,000	\$400,000
Weighted average expected revenue	\$357,500	\$565,000

FIGURE 1-6 Revenue projections for DrōnTeq Client Services project.

Steering Committee Approval

Carmella presented the system request for the Client Services project to the DrōnTeq IS project steering committee at its next meeting. Response to the request was uniformly positive. The strong support for the project by Eric and Peter, the company's top executives, helped to spur the committee's rapid approval of the project. Following approval of the system request, Jiang Tsiao, a senior systems analyst in the IS department, was assigned to work with Carmella to develop a preliminary feasibility analysis for the project.

Feasibility Analysis

Once the need for the system and its business requirements have been defined, the approval committee authorizes the systems analyst to prepare a more detailed business case to better understand the proposed IS project. Feasibility analysis guides the organization in determining whether to proceed with the project. Feasibility analysis also identifies the important *risks* associated with the project that must be managed if the project is approved. As with the system request, each organization has its own process and format for the feasibility analysis, but most include techniques to assess three areas: technical feasibility, economic feasibility, and organizational feasibility (Figure 1-7). The results of evaluating these three feasibility factors are combined into a **feasibility study** deliverable that is submitted to the approval committee.

Technical Feasibility: Can We Build It?

- Familiarity with application: Less familiarity generates more risk.
- Familiarity with technology: Less familiarity generates more risk.
- Project size: Large projects have more risk.
- Compatibility: The harder it is to integrate the system with the company's existing technology, the higher the risk will be.

Economic Feasibility: Should We Build It?

- Development costs
- Annual operating costs
- Annual benefits (cost savings and/or increased revenues)
- Intangible benefits and costs

Organizational Feasibility: If We Build It, Will They Come?

- Is the project strategically aligned with the business?
- Project champion(s)
- Senior management
- Users
- Other stakeholders

FIGURE 1-7 Feasibility analysis assessment factors. A template for this figure is available on the student website.

You might wonder at the omission of the element of time as a risk factor for the project. While the time available for a project can certainly be a concern, we consider time to be a project management issue. We will discuss project management strategies that can be used when time is tight in Chapter 2.

Although we will discuss feasibility analysis now within the context of project initiation, most project teams revise the feasibility study throughout the SDLC and revisit its contents at various checkpoints during the project. If at any point the project's risks and limitations outweigh its benefits, the project team may decide to cancel the project or make substantial revisions.

Technical Feasibility

The first issue in the feasibility analysis is to assess the **technical feasibility** of the project, the extent to which the system can be successfully designed, developed, and installed by the IT group. Technical feasibility analysis is, in essence, a *technical risk analysis* that strives to answer the question: “Can we build it?”³

Many risks can endanger the successful completion of the project. First and foremost is the users' and analysts' **familiarity with the application**. When analysts are unfamiliar with the business application area, they have a greater chance of misunderstanding the users or missing opportunities for improvement. The risks increase dramatically when the users themselves have limited knowledge of the application. If the project involves a new business innovation, neither the users nor the analysts may have any direct knowledge or experience of the proposed new application. In general, the development of new systems is riskier than extensions to an existing system, because existing systems tend to be better understood.

Familiarity with the technology is another important source of technical risk. When a system uses technology that has not been used before *within the organization*, there is a greater chance that problems and delays will occur because of the need to learn how to use the technology. Risk increases dramatically when the technology itself is new (e.g., a Big Data project using Hadoop). When the technology is not new but the organization lacks experience with it, technical risk is reduced somewhat, since outside expertise should be available from vendors and consultants.

Project size is an important consideration, whether measured as the number of people on the development team, the length of time it will take to complete the project, or the number of distinct features in the system. Larger projects present more risk, because they are more complicated to manage and because there is a greater chance that some important system requirements will be overlooked or misunderstood. Large systems are typically highly integrated with other systems, increasing project complexity.

Finally, project teams need to consider the **compatibility** of the new system with the technology that already exists in the organization. Systems are rarely built in a vacuum—they are built in organizations that have numerous systems already in place. New technology and applications need to be able to integrate with the existing environment for many reasons. They may rely on data from existing systems, they may produce data that feed other applications, and they may have to use the company's existing communications infrastructure. A new CRM system, for example, has little value if it does not use customer data found across the organization in existing sales systems, marketing applications, and customer service systems.

The assessment of a project's technical feasibility is not cut and dried, because in many cases, some interpretation of the underlying conditions is needed (e.g., how large does a project need to grow before it is considered “big”?). One approach is to compare the project with prior projects undertaken by the organization. Another option is to consult with experienced IT professionals in the organization or with external IT consultants; often, they will be able to judge whether a project is feasible from a technical perspective.

³We use the words “build it” in the broadest sense. Organizations can also choose to buy a commercial software package and install it, in which case the question might be “Can we select the right package and successfully install it?”

Economic Feasibility

The second element of a feasibility analysis is to perform an **economic feasibility** analysis (also called a **cost–benefit analysis**). This attempts to answer the question “*Should* we build the system?” Economic feasibility is determined by identifying costs and benefits associated with the system, assigning values to them, calculating future cash flows, and measuring the financial worthiness of the project. As a result of this analysis, the financial opportunities and risks of the project can be understood. Keep in mind that organizations have limited capital resources and multiple projects will be competing for funding. The more expensive the project, the more rigorous and detailed the analysis should be. Before illustrating this process with a detailed example, we first introduce the framework we will apply to evaluate project investments and the common assessment measures that are used.

Cash Flow Analysis and Measures

IT projects commonly involve an initial investment that produces a stream of benefits over time, along with some ongoing support costs. Therefore, the value of the project must be measured over time. Cash flows, both inflows and outflows, are estimated over some future period. Then, these cash flows are evaluated using several techniques to judge whether the projected benefits justify incurring the costs.

A very basic cash flow projection is shown in Figure 1-8 to demonstrate these evaluation techniques. In this simple example, a system is developed in Year 0 (the current year) costing \$100,000. Once the system is operational, benefits and on-going costs are projected over 3 years. In row 3 of this figure, net benefits are computed by subtracting each year’s total costs from its total benefits. Finally, in row 4, we have computed a cumulative total of the net cash flows.

	Year 0	Year 1	Year 2	Year 3	Total
Total Benefits		45,000	50,000	57,000	152,000
Total Costs	100,000	10,000	12,000	16,000	138,000
Net Benefits					
③ (Total Benefits – Total Costs)	(100,000)	35,000	38,000	41,000	14,000
④ Cumulative Net Cash Flow	(100,000)	(65,000)	(27,000)	14,000	

FIGURE 1-8 Simple cash flow projection.

Two of the common methods for evaluating a project’s worth can now be determined. Each of these calculations will be explained here:

Return on Investment The return on investment (ROI) is a calculation that measures the average rate of return earned on the money invested in the project. ROI is a simple calculation that divides the project’s net benefits (total benefits – total costs) by the total costs. The ROI formula is

$$\text{ROI} = \frac{\text{Total Benefits} - \text{Total Costs}}{\text{Total Costs}}$$

$$\text{ROI} = \frac{152,000 - 138,000}{138,000} = \frac{14,000}{138,000} = 10.14\%$$

A high ROI suggests that the project’s benefits far outweigh the project’s cost, although exactly what constitutes a “high” ROI is unclear. ROI is commonly used in practice; however, it is hard to interpret and should not be used as the only measure of a project’s worth.

Break-Even Point Another common approach to measuring a project's worth is the break-even point. The **break-even point** (also called the **payback method**) is defined as the number of years it takes a firm to recover its original investment in the project from net cash flows. As shown in row 4 of Figure 1-8, the project's cumulative cash flow figure becomes positive during Year 3, so the initial investment is "paid back" over 2 years plus some fraction of the third year.

(In the year in which Cumulative Cash Flow turns positive:)

$$\text{BEP} = \frac{\text{Number of years of negative cash flow}}{\text{negative cash flow}} + \frac{\text{That year's Net Cash Flow} - \text{That year's Cumulative Cash Flow}}{\text{That year's Net Cash Flow}}$$

Using the values in Figure 1-8, the BEP calculation is

$$\text{BEP} = 2 + \frac{41,000 - 14,000}{41,000} = 2 + \frac{28,000}{41,000} = 2.68 \text{ years}$$

The break-even point is intuitively easy to understand and does give an indication of a project's liquidity, or the speed at which the project generates cash returns. Also, projects that produce higher returns early in the project's life are thought to be less risky, since we can anticipate near-term events with more accuracy than long-term events. The break-even point ignores cash flows that occur after the break-even point has been reached; therefore, it is biased against longer-term projects.

Discounted Cash Flow Technique The simple cash flow projection shown in Figure 1-8, and the return on investment and break-even point calculations all share the weakness of not recognizing the time value of money. In these analyses, the timing of cash flows is ignored. A dollar in Year 3 of the project is considered to be exactly equivalent to a dollar received in Year 1.

Discounted cash flows are used to compare the present value of all cash inflows and outflows for the project in today's dollar terms. The key to understanding present values is to recognize that if you had a dollar today, you could invest it and receive some rate of return on your investment. Therefore, a dollar received in the future is worth less than a dollar received today, since you forgo that potential return. If you have a friend who owes you \$100 today, but instead gives you that \$100 in 3 years—you've been had! Assuming you could have invested those dollars at a 10% rate of return, you will be receiving the equivalent of \$75 in today's terms.

The basic formula to convert a future cash flow to its present value is

$$\text{PV} = \frac{\text{Cash flow amount}}{(1 + \text{Rate of return})^n}, \text{ where } n \text{ is the year in which the cash flow occurs.}$$

The rate of return used in the present value calculation is sometimes called the required rate of return, or the cost of obtaining the capital needed to fund the project. Many organizations will have determined the appropriate rate of return to use when analyzing IT investments. The systems analyst should consult with the organization's finance department.

Using our previous illustration, \$100 received in 3 years with a required rate of return of 10% has a PV of \$75.13.

$$\text{PV} = \frac{100}{(1 + 0.1)^3} = \frac{100}{1.331} = 75.13$$

In Figure 1-9, the present value of the projected benefits and costs shown in Figure 1-8 have been calculated using a 10% required rate of return.

	Year 0	Year 1	Year 2	Year 3	Total
Total Benefits		45,000	50,000	57,000	
PV of Total Benefits		40,909	41,322	42,825	125,056
Total Costs	100,000	10,000	12,000	16,000	
PV of Total Costs	100,000	9,091	9,917	12,021	131,029

FIGURE 1-9
Discounted cash flow
projection.

Net Present Value (NPV) The NPV is simply the difference between the total present value of the benefits and the total present value of the costs.

$$\begin{aligned}\text{NPV} &= \sum \text{PV of Total Benefits} - \sum \text{PV of Total Costs} \\ &= \$125,056 - \$131,029 = (\$5,973)\end{aligned}$$

As long as the NPV is greater than zero, the project is considered economically acceptable. Unfortunately for this project, the NPV is less than zero, indicating that for a required rate of return of 10%, this project should not be accepted. The required rate of return would have to be something less than 6.65% before this project returns a positive NPV. This example illustrates the fact that sometimes the “naïve” techniques of ROI and BEP find that the project appears acceptable, but the more rigorous and financially correct NPV technique finds the project is unacceptable.

Figure 1-10 reviews the steps involved in performing an economic feasibility analysis. Each step will be illustrated by an example in the upcoming sections.

Identify Costs and Benefits

The systems analyst’s first task when developing an economic feasibility analysis is to identify the kinds of costs and benefits the system will have and list them along the left-hand column of a spreadsheet. Figure 1-11 lists examples of costs and benefits that may be included. The costs and

1. Identify Costs and Benefits	List the tangible costs and benefits for the project. Include both one-time and recurring costs.
2. Assign Values to Costs and Benefits	Work with business users and IT professionals to create numbers for each of the costs and benefits. Even intangibles should be valued if possible.
3. Determine Cash Flow	Forecast what the costs and benefits will be over a certain period, usually, 3–5 years. Apply a growth rate to the values, if necessary.
4. Assess Project’s Economic Value	Evaluate the project’s expected returns in comparison to its costs. Use one or more of the following evaluation techniques:
• Return on Investment (ROI)	Calculate the rate of return earned on the money invested in the project, using the ROI formula.
• Break-Even Point (BEP)	Find the year in which the cumulative project benefits exceed cumulative project costs. Apply the break-even formula, using figures for that year. This calculation measures how long it will take for the system to produce benefits that cover its costs.
• Net Present Value (NPV)	Restate all costs and benefits in today’s dollar terms (present value), using an appropriate discount rate. Determine whether the total present value of benefits is greater than or less than the total present value of costs.

FIGURE 1-10 Steps
to conduct an economic
feasibility analysis.

FIGURE 1-11
Example of costs
and benefits for
economic feasibility.

Development Costs	Operational Costs
Development team salaries	Software upgrades
Consultant fees	Software licensing fees
Development training	Hardware repair and upgrades
Hardware and software	Cloud storage fees
Vendor installation	Operational team salaries
Office space and equipment	Communications charges
Data conversion costs	User training
Tangible Benefits	Intangible Benefits
Increased sales	Increased market share
Reductions in staff	Increased brand recognition
Reductions in inventory	Higher-quality products
Reductions in IT costs	Improved customer service
Better supplier prices	Better supplier relations

benefits can be broken down into four categories: (1) development costs, (2) operational costs, (3) tangible benefits, and (4) intangibles. **Development costs** are those tangible expenses that are incurred during the creation of the system, such as salaries for the project team, hardware and software expenses, consultant fees, training, and office space and equipment. Development costs are usually thought of as one-time costs. **Operational costs** are those tangible costs that are required to operate the system, such as the salaries for operations staff, software licensing fees, equipment upgrades, and cloud vendor fees. Operational costs are usually thought of as ongoing costs. As you can see from the list of Operational Costs in Figure 1-11, it is important to include every relevant cost factor over the life of the system, so that we estimate the **Total Cost of Ownership (TCO)**.

Tangible benefits include revenue that the system enables the organization to collect, such as increased sales. In addition, the system may enable the organization to avoid certain costs, leading to another type of tangible benefit: cost savings. For example, if the system produces a reduction in needed staff, lower salary costs result. Similarly, a reduction in required inventory levels due to the new system produces lower inventory costs. In these examples, the reduction in costs is a tangible benefit of the new system.

Of course, a project also can affect the organization's bottom line by reaping **intangible benefits** or incurring **intangible costs**. Intangible costs and benefits are more difficult to incorporate into the economic feasibility analysis because they are based on intuition and belief rather than on "hard numbers." Nonetheless, they should be listed in the spreadsheet along with the tangible items.

Assign Values to Costs and Benefits

Once the types of costs and benefits have been identified, the analyst needs to assign specific dollar values to them. This may seem impossible—How can someone quantify costs and benefits that have not happened yet? And how can those predictions be realistic? Although this task is exceedingly difficult, you must do the best you can to come up with reasonable numbers for all of the costs and benefits. Only then can the approval committee make an informed decision about whether to move ahead with the project.

The most effective strategy for estimating costs and benefits is to rely on the people who have the best understanding of them. For example, costs and benefits that are related to the technology or the project itself can be provided by the company's IT group or external consultants, and business users can develop the numbers associated with the business (e.g., sales projections, order levels). The company also can consider past projects, industry reports, and vendor information, although these sources probably will be a bit less accurate. Likely, all the estimates will be revised as the project proceeds.

If predicting a specific value for a cost or benefit is proving difficult, it may be useful to estimate a range of values for the cost or benefit and then assign a likelihood (probability) estimate to each value. With this information, an *expected value* for the cost or benefit can be calculated. Recall the calculations shown in Figure 1-6 in which the DrönTeq staff developed expected values for projected revenue. As more information is learned during the project, the value estimates and the probability estimates can be revised, resulting in a revised expected value for the cost or benefit.

What about the *intangible* benefits and costs? Sometimes, it is acceptable to list intangible benefits, such as improved customer service, without assigning a dollar value. Other times, estimates have to be made regarding how much an intangible benefit is “worth.” We suggest that you quantify intangible costs or benefits if possible. If you do not, how will you know if they have been realized? Suppose that a system claims to improve customer service. This benefit is intangible but let us assume that the improvement in customer service will decrease the number of customer complaints by 10% each year over 3 years and that \$200,000 is currently spent on phone charges and phone operators who handle complaint calls. Suddenly, we have some very tangible numbers with which to set goals and measure the originally intangible benefit.

A detailed cost–benefit analysis is shown in Figure 1-12. In this example, benefits accrue because the project is expected to increase sales, reduce customer complaint calls, and lower

	2022	2023	2024	2025	2026	Total
Benefits						
Increased sales		500,000	530,000	561,800	595,508	2,187,308
Reduction in customer complaint calls ^a		70,000	70,000	70,000	70,000	280,000
Reduced inventory costs		68,000	68,000	68,000	68,000	272,000
Total Benefits ^b		638,000	668,000	699,800	733,508	2,739,308
Development Costs						
2 servers @ \$125,000	250,000	0	0	0	0	250,000
Printer	100,000	0	0	0	0	100,000
Software licenses	34,825	0	0	0	0	34,825
Server software	10,945	0	0	0	0	10,945
Development labor	1,236,525	0	0	0	0	1,236,525
Total Development Costs	1,632,295	0	0	0	0	1,632,295
Operational Costs						
Hardware		50,000	50,000	50,000	50,000	200,000
Software		20,000	20,000	20,000	20,000	80,000
Operational labor		115,000	119,600	124,384	129,359	488,343
Total Operational Costs		185,000	189,600	194,384	199,359	768,343
Total Costs	1,632,295	185,000	189,600	194,384	199,359	2,400,638
Total Benefits – Total Costs	(1,632,295)	453,000	478,400	505,416	534,149	338,670
Cumulative Net Cash Flow	(1,632,295)	(1,179,295)	(700,895)	(195,479)	338,670	
Return on Investment (ROI)	14.1%	(338,670/2,400,638)				
Break-Even Point	3.37 years	(3 years of negative cumulative cash flow + [534,149 – 338,670]/534,149 = 0.37)				
^a Customer service values are based on reduced costs of handling customer complaint phone calls.						
^b An important yet intangible benefit will be the ability to offer services that our competitors currently offer.						

FIGURE 1-12 Cost–benefit analysis—simple cash flow method.

inventory costs. For simplicity, all development costs are assumed to occur in the current year 2022, and all benefits and operational costs are assumed to begin when the system is implemented at the start of 2023 and continue through 2026. Notice that the customer service intangible benefit has been quantified, based on a decrease in customer complaint phone calls. The intangible benefit of being able to offer services that competitors currently offer was not quantified, but it was listed so that the approval committee will consider the benefit when assessing the system's economic feasibility.

Determine Cash Flow

A formal cost-benefit analysis usually contains costs and benefits over a selected number of years (usually, 3–5 years) to show cash flow over time (Figures 1-8 and 1-12). For example, Figure 1-12 lists the same amount for customer complaint calls, inventory costs, hardware, and software for all 4 years. Often, amounts are augmented by some rate of growth to adjust for inflation or business improvements, as shown by the 6% increase that is added to the sales numbers in the sample spreadsheet. Similarly, labor costs are assumed to increase at a 4% rate each year. Finally, totals are added to determine the overall benefits and costs.

Determine ROI

Figure 1-12 includes the ROI calculation for our example project. This project's ROI is calculated to be 14.1%.

Determine BEP

Figure 1-12 also includes the BEP calculation for our example project. This project's BEP is calculated to be 3.37 years.

Determine NPV

In Figure 1-13, the present value of the costs and benefits has been calculated and added to our example spreadsheet, using a 6% rate of return. The NPV is simply the difference between the total present value of the benefits and the total present value of the costs. If the NPV is greater than zero, the project is considered economically viable. In this example, since NPV is \$68,292, the project should be accepted from an economic feasibility perspective.

CONCEPTS IN ACTION 1-D

Intangible Value at Carlson Hospitality

I conducted a case study at Carlson Hospitality, a global leader in hospitality services, encompassing more than 1,300 hotel, resort, restaurant, and cruise ship operations in 79 countries. One of its brands, Radisson Hotels & Resorts, researched guest stay information and guest satisfaction surveys. The company was able to quantify how much of a guest's lifetime value can be attributed to his or her perception of the stay experience. As a result, Radisson knows how much of the collective future value of the enterprise is at stake, given the perceived quality of the stay experience. Using this model, Radisson can

confidently show that a 10% increase in customer satisfaction among the 10% of highest-quality customers will capture a one-point market share for the brand. Each point in market share for the Radisson brand is worth \$20 million in additional revenue. *Barbara Wixom*

Question

How can a project team use this information to help determine the economic feasibility of a system?

	2022	2023	2024	2025	2026	Total
Benefits						
Increased sales		500,000	530,000	561,800	595,508	
Reduction in customer complaint calls ^a		70,000	70,000	70,000	70,000	
Reduced inventory costs		68,000	68,000	68,000	68,000	
Total Benefits^b		638,000	668,000	699,800	733,508	
Present Value Total Benefits		601,887	594,518	587,566	581,007	2,364,978
Development Costs						
2 Servers @ \$125,000	250,000	0	0	0	0	
Printer	100,000	0	0	0	0	
Software licenses	34,825	0	0	0	0	
Server software	10,945	0	0	0	0	
Development labor	1,236,525	0	0	0	0	
Total Development Costs	1,632,295	0	0	0	0	
Operational Costs						
Hardware		50,000	50,000	50,000	50,000	
Software		20,000	20,000	20,000	20,000	
Operational labor		115,000	119,600	124,384	129,359	
Total Operational Costs		185,000	189,600	194,384	199,359	
Total Costs	1,632,295	185,000	189,600	194,384	199,359	
Present Value Total Costs	1,632,295	174,528	168,743	163,209	157,911	2,296,686
NPV (PV Total Benefits – PV Total Costs)						68,292
^a Customer service values are based on reduced costs of handling customer complaint phone calls.						
^b An important yet intangible benefit will be the ability to offer services that our competitors currently offer.						

FIGURE 1-13 Cost–benefit analysis—discounted cash flow method.

Organizational Feasibility

The **organizational feasibility** of the system concerns how well the system ultimately will be accepted by its users and incorporated into the ongoing operations of the organization. There are many organizational factors that can have an impact on the project, and seasoned developers know that organizational feasibility can be the most difficult feasibility dimension to assess. In essence, an organizational feasibility analysis attempts to answer the question “If we build it, will they come?”

One way to assess the organizational feasibility of the project is to understand how well the goals of the project align with business objectives. **Strategic alignment** is the fit between the project and business strategy—the greater the alignment, the less risky the project will be, from an organizational feasibility perspective. For example, if the marketing department has decided to become more customer focused, then a CRM project that produces integrated customer information would have strong strategic alignment with marketing’s goal. Many projects fail if the IT department alone initiates them and there is little or no alignment with business-unit or organizational strategies.

A second way to assess organizational feasibility is to conduct a **stakeholder analysis**.⁴ A **stakeholder** is a person, group, or organization that can affect (or can be affected by) a new system. In general, the most important stakeholders in the introduction of a new system are the project champion, organizational management, and system users (Figure 1-14), but systems sometimes affect other stakeholders as well. For example, a change to a purchasing system will probably affect the firm's supply chain partners.

The **champion** is a high-level executive and is usually, but not always, the project sponsor who created the system request. The champion supports the project by providing time and resources (e.g., money) and by giving political support to the project by conveying its importance to other decision makers. More than one champion is preferable because if the champion leaves the organization, the support could leave as well.

While champions provide day-to-day support for the system, **organizational management** also needs to support the project. Such management support conveys to the rest of the organization the belief that the system will make a valuable contribution and that necessary resources will be made available. Ideally, the management should encourage people in the organization to use the system and to accept the many changes that the system will likely create.

A third important set of stakeholders is the **system users** who ultimately will use the system once it has been installed in the organization. Too often, the project team meets with users at the beginning of a project and then disappears until after the system is created. In this situation, the final product rarely meets the expectations and needs of those who are supposed to use it, because needs change and users become savvier as the project progresses. User participation should be promoted throughout the development process to make sure that the final system will be accepted and used, by getting users actively involved in the development of the system (e.g., performing tasks, providing feedback, and making decisions).

The third column in Figure 1-14 suggests that actions can be taken that influence organizational feasibility. When the organizational feasibility assessment reveals high risks, the team members should employ actions like these to overcome the organizational feasibility concerns.

	Role	To Enhance Organizational Feasibility
Champion	A champion: • Initiates the project • Promotes the project • Allocates his or her time to the project • Provides resources	• Make a presentation about the objectives of the project and the proposed benefits to those executives who will benefit directly from the system. • Create a prototype of the system to demonstrate its potential value.
Organizational Management	Organizational managers: • Know about the project • Budget enough money for the project • Encourage users to accept and use the system	• Make a presentation to the management about the objectives of the project and the proposed benefits. • Market the benefits of the system, using memos and organizational newsletters. • Encourage the champion to talk about the project with his organizational newsletters or her peers.
System Users	Users: • Make decisions that influence the project • Perform hands-on activities for the project • Ultimately determine whether the project is successful using or not using the system	• Assign users official roles on the project team. • Assign users specific tasks to perform, with clear deadlines. • Ask for feedback from users regularly (e.g., at weekly meetings).

FIGURE 1-14
Important stakeholders for organizational feasibility.

⁴A good book on stakeholder analysis that presents a series of stakeholder analysis techniques is R. O. Mason and I. I. Mitroff, *Challenging Strategic Planning Assumptions: Theory, Cases, and Techniques*, New York: John Wiley & Sons, 1981.

CONCEPTS IN ACTION 1-E**Return on Investment**

Many companies are undergoing *server virtualization*. This is the concept of putting multiple “virtual” servers onto one physical device. The payoffs can be significant: fewer servers, less electricity, less generated heat, less air conditioning, less infrastructure and administration costs, increased flexibility, less physical presence (i.e., smaller server rooms), faster maintenance of servers, and more. There are costs, of course, such as licensing the virtualization software, labor costs in establishing the virtual servers onto a physical device, labor costs in updating tables, and access. But determining the return on

investment can be a challenge. Some companies have lost money on server virtualization, while most would say that they have gained a positive return on investment but have not really quantified the results.

Questions

1. How might a company really determine the return on investment for server virtualization?
2. Is this a project that a systems analyst might be involved in? Why or why not?

YOUR TURN 1-4**Too Much Paper, Part 2**

Review the description of the South Dakota workers’ compensation project in Your Turn 1-3. There were legal hurdles to implementing a digital solution to handle workers’ compensation claims. One hurdle was that the previous paper method had physical signatures from employees signing off that they had received treatment or that the doctor had signed off on medical treatment performed. How could such permissions be preserved and duplicated digitally?

In addition, some clerks were afraid that the digital solution might not work. What if they could not find an electronic file on the computer? What if a hard drive crashed or the files

were accidentally deleted? What if they could not retrieve the electronic file?

Questions

1. What legal issues might arise from having only “digital signatures” or only electronic/paper copies of documents instead of physical documents? How do these issues affect the project’s feasibility?
2. In terms of organizational feasibility and adoption, what might an analyst do to convince these clerks to adopt and use the new technology?

The final feasibility study helps organizations make wiser investments regarding IS because it forces project teams to consider technical, economic, and organizational factors that can affect their projects. It protects IT professionals from criticism by keeping the business units educated about decisions and positioned as the leaders in the decision-making process. Remember—the feasibility study should be revised throughout the project at points where the project team makes critical decisions about the system (e.g., before the design begins). The final feasibility study can be used to support and explain the critical choices that are made throughout the SDLC.

Applying the Concepts at DrōnTeq

The steering committee met and placed the Client Services project high on its list of projects.

The next step was for Carmella and Jiang to develop the feasibility analysis. Figure 1-15 presents the executive summary page of the feasibility study. The report itself was about 10 pages long and provided additional detail and supporting documentation.

As shown in Figure 1-15, the project is somewhat risky from a technical perspective. DrōnTeq has experience with the technology that will be used, but the proposed application has some unfamiliar elements. User involvement will be important. Project size is moderate, and the system should be very compatible with the existing infrastructure.

Client Services Project Executive Summary

Carmella Herrera and Jiang Tsaio created the following feasibility analysis for the DrönTeq Client Services Project. The System Request is attached, along with the detailed feasibility study. The highlights of the feasibility analysis are as follows:

Technical Feasibility

The Client Services project is feasible technically, although there is some risk.

DrönTeq's risk regarding familiarity with a customer-facing drone service request system is moderate.

- The Sales Department uses a customer-facing system to allow customers to configure and place orders for commercial drone purchases. This system was developed by the DrönTeq IS department.
- The Client Service business model contains an unfamiliar element—the use of a bidding approach to obtain offers from pilots and determine the winning bid based on multiple factors.
- Business user involvement will be essential.

DrönTeq's risk regarding familiarity with the technology is low.

- The IT department has extensive knowledge of the current Web-based customer order system and the databases and Internet technology it uses.
- The technology used in the proposed Client Services Project will be very similar to existing systems.

The project size is considered moderately low.

- Project scope has been deliberately limited to the front-end of this overall system: customer request, pilot notification, pilot bidding, and flight assignment.
- The project team will likely consist of five or fewer people.

The compatibility with DrönTeq's existing technical infrastructure should be good.

- An Internet infrastructure is already in place at corporate headquarters.
- The system will be based on existing technology infrastructure currently supporting the Sales Department.

Economic Feasibility

A cost–benefit analysis was performed; see the attached spreadsheet for details (provided in Appendix 1A). Conservative estimates show that the Client Services project has a good chance of enhancing the company's bottom line.

ROI over 3 years: 43%

NPV over 3 years: \$675,818

Break-even occurs after 1.62 years

Intangible Costs and Benefits

Enhanced competitive position through expansion of our drone brand into the drone flight service market. Clients who don't wish to own and operate their own drones will still have a convenient and cost-effective way to receive the benefits provided from our drone flights and data analysis services.

Organizational Feasibility

From an organizational perspective, this project has moderately high risk.

- *Top management support:* The top executives of the company strongly support the project.
- *Project champion:* Carmella Hererra is a respected and knowledgeable business executive.
- *Organizational management:* Overall, managers throughout DrönTeq support the creation of the new business unit. The Sales department, however, may experience some drone sales loss as some prospective customers choose to purchase drone flight services rather than purchase and operate drones themselves.
- *Customers:* Customers will expect a user interface that is clear and simple to use. Customers will want to enter basic facts one time and have those facts stored securely. This will enable them to request repeat flight services quickly and easily. Customers will expect prompt response and accurate status information on all flight service requests. Without these features, customers may be unwilling to use this service.
- *Pilots:* Pilots will depend on this system to provide notification of potential drone flights, bid on flights, and receive flight assignments; therefore, pilots will demand a system that is quick and easy to use and that embodies a fair and consistent bidding and flight assignment mechanism. Otherwise, pilots will reject the business model of the Client Services business unit and the venture's success is doubtful.

Additional Comments

- The top executives view this as a strategic system. This system will allow us to extend our drone services to a new audience. Our marketing research tells us this market is strong and we believe the services will be well accepted.
- To enhance acceptance of the new service, the introduction of the system should coincide with the agricultural growing season since agricultural users are a primary audience.

FIGURE 1-15 Feasibility analysis executive summary for DrönTeq.

The economic feasibility analysis includes the assumptions that Carmella made in the system request. The summary spreadsheet that led to the values in the feasibility analysis has been included in Appendix 1A. Development costs are expected to be about \$558,000. This is a very rough estimate, as Jiang has had to make some assumptions about the amount of time it will take to design and program the system. Nonetheless, the Client Services project appears to be very strong economically.

The organizational feasibility is presented in Figure 1-15. There is a strong champion, well placed in the organization, to support the project. The project originated in the business or functional side of the company, not the IS department, and support for the project among the senior management team is strong.

Additional stakeholders in the project are the managers throughout the organization, customers, and drone pilots. Organizational managers are supportive of the new Client Services business unit. The Sales department may lose some drone sales if prospective drone purchasers choose to use the drone flight services rather than buy and operate a drone themselves. Customer acceptance of the drone flight service product will depend, in part, on the quality, simplicity, and speed of the user interface of the system that enables quick and easy flight requests. Pilot recruitment and retention will require the system to be quick and easy to use and provide a fair and consistent bidding and flight assignment mechanism.

CHAPTER REVIEW

After reading and studying this chapter, you should be able to:

- Explain the role of the systems analyst in the process of developing IS.
- Discuss the skills needed to be a successful systems analyst.
- List and explain the four primary phases of the SDLC.
- Explain the ways that projects are identified and initiated.
- Explain why it is important to ensure that a proposed IS will add value to the organization.
- Describe the purpose of the system request and explain the contents of its four main sections.
- Be able to create a system request for a proposed project.
- Discuss the purpose of the feasibility study.
- Describe the issues that are considered when evaluating a project's technical feasibility.
- Be able to develop an economic feasibility assessment for a project.
- Understand and evaluate the organizational feasibility of a project.

KEY TERMS

Analysis models	Business requirements	Familiarity with the technology	Organizational management	Strategic alignment
Analysis phase	Business value	Feasibility analysis	Payback method	Support plan
Analysis strategy	Champion	Feasibility study	Phases	System proposal
Approval committee	Change management analyst	First mover	Planning phase	System request
Architecture design	Compatibility	Gradual refinement	Program design	System specification
As-is system	Construction	Implementation phase	Project initiation	System users
Break-even point	Cost-benefit analysis	Infrastructure analyst	Project management	Systems analyst
Business analyst	Database and file specifications	Installation	Project manager	Systems development life cycle (SDLC)
Business need	Deliverables	Intangible benefits	Project size	Tangible benefits
Business process automation (BPA)	Design phase	Intangible costs	Project sponsor	Tangible value
Business process improvement (BPI)	Design strategy	Intangible value	Requirements analyst	Technical feasibility
Business process management (BPM)	Development costs	Interface design	Software architect	Technical risk analysis
Business process reengineering (BPR)	Economic feasibility	Net present value (NPV)	Special issues	Technique
	Emerging technology	Operational costs	Stakeholder	To-be system
	Familiarity with the application	Organizational feasibility	Stakeholder analysis	Training
			Steering committee	Total cost of ownership (TCO)
			Step	

QUESTIONS

1. List and describe the six general skills all project team members should have.
2. What are the major roles on a project team?
3. Compare and contrast the role of a systems analyst, business analyst, and infrastructure analyst.
4. Compare and contrast the role of requirements analyst, change management analyst, and project manager.
5. Describe the major phases in the systems development life cycle (SDLC).
6. Describe the principal steps in the planning phase. What are the major deliverables?
7. Describe the principal steps in the analysis phase. What are the major deliverables?
8. Describe the principal steps in the design phase. What are the major deliverables?
9. Describe the principal steps in the implementation phase. What are the major deliverables?
10. Which phase in the SDLC is the most important?
11. What does *gradual refinement* mean in the context of SDLC?
12. Describe the four steps of BPM. Why do companies adopt BPM as a management strategy?
13. Compare and contrast BPA, BPI, and BPR. Which is most risky? Which has the greatest potential value?
14. Give three examples of business needs for a system.
15. Describe the roles of the project sponsor and the approval committee.
16. What is the purpose of an approval committee? Who is usually on this committee?
17. Why should the system request be created by a businessperson as opposed to an IS professional?
18. What is the difference between intangible value and tangible value? Give three examples of each.
19. What are the purposes of the system request and the feasibility analysis? How are they used in the project selection process?
20. Describe two special issues that may be important to list on a system request.
21. Describe the three dimensions of feasibility analysis.
22. What factors are used to determine project size?
23. Describe a “risky” project in terms of technical feasibility. Describe a project that would *not* be considered risky.
24. What are the steps for assessing economic feasibility? Describe each step.
25. List two intangible benefits. Describe how these benefits can be quantified.
26. List two tangible benefits and two operational costs for a system. How would you determine the values that should be assigned to each item?
27. Explain how an expected value can be calculated for a cost or benefit. When would this be done?
28. Explain the net present value and return on investment for a cost–benefit analysis. Why would these calculations be used?
29. What is the break-even point for the project? How is it calculated?
30. What is stakeholder analysis? Discuss three stakeholders that would be relevant for most projects.

EXERCISES

- A. Go to www.bls.gov and perform a search for “systems analyst.” What is the employment outlook for this career? Compare and contrast the skills listed with the skills that were presented in this chapter.
- B. Think about your ideal analyst position. Write a job posting to hire someone for that position. What requirements would the job have? What skills and experience would be required? How would applicants demonstrate that they have the appropriate skills and experience?
- C. Locate a news article in an IT trade website (e.g., Computerworld.com, InformationWeek.com) about an organization that is implementing a new computer system. Describe the tangible and intangible values that the organization seeks from the new system.
- D. Car dealers have realized how profitable it can be to sell automobiles by using the Web. Pretend that you work for a local car dealership that is part of a large chain such as CarMax. Create a system request that you might use to develop a Web-based sales system. Remember to list special issues that are relevant to the project.
- E. Think about your own university or college and choose an idea that could improve student satisfaction with the course enrollment process. Currently, can students enroll for classes from anywhere? How long does it take? Are directions simple to follow? Is online help available? Next, think about how technology can help support your idea. Would you need completely new technology? Can the current system be changed?

- F. For exercise E, create a system request that you could give to the administration that explains the sponsor, business need, business requirements, and potential value of the project. Include any constraints or issues that should be considered.
- G. Think about the idea that you developed in Exercise E to improve your university or college course enrollment process. List three things that influence the technical feasibility of the system, the economic feasibility of the system, and the organizational feasibility of the system. How can you learn more about the issues that affect the three kinds of feasibility?
- H. Amazon.com was successful when it decided to extend its offerings beyond books to many other products. Amazon.com was unable to compete successfully with eBay.com's auction site, however, and eventually abandoned its own auction site. What feasibility factors probably had the most significance in this failure? Explain.
- I. Interview someone who works in a large organization and ask him or her to describe the approval process that exists for proposed new development projects. What do they think about the process? What are the problems? What are the benefits?
- J. Reread the "Your Turn 1-2" (Implementing a Satellite Data Network). Create a list of the stakeholders that should be considered in a stakeholder analysis of this project.

MINICASES

1. Megan Simpson, manager of western regional sales at the Whitefield Company, requested that the IS department develop a sales force communication and tracking system that would enable her to better keep up with her sales staff. Megan wanted to be able to post messages to her team on many topics, including sales tips and strategies, update them on the firm's products, and point out changes in the competitive environment. She also wanted her team to be able to post responses to her posts plus their own ideas, update their schedules, and share their sales success stories.

Unfortunately, due to the massive backlog of work facing the Whitefield Company's IS department, her request was given a low priority. After 6 months of inaction by the IS department, Megan decided to take matters into her own hands. Following the advice of friends, Megan set up a Word Press site to use as a sales force communication and tracking system.

Although it took longer than expected, Megan's site has been "completed" for about 6 weeks. It still has many features that do not work very well, and some functions lead to dead ends. Members of the sales force initially were quite interested in the system. They quickly discovered, however, that the system was confusing and did not seem to provide many benefits, so their interest quickly waned. Megan's assistant is so mistrustful of the scheduling information posted on the site that she has secretly gone back to using her old paper-based system of tracking the sales staff's activities, since it is much more reliable.

Over dinner one evening, Megan complained to a systems analyst friend, "I don't know what went wrong with this project. It seemed pretty simple to me. The IS guys gave me some suggestions for how I should approach this project, but it seemed like such an elaborate set of steps and tasks. I didn't think all that really applied to this small system. I just thought I'd set up the basics for the system and then tweak it around until I got what I wanted without all the fuss and bother of the

approach the IS guys were pushing. I mean, doesn't that just apply to their big, expensive system projects?"

To understand where Megan went wrong, apply what you know about the SDLC to answer the following questions:

A. Planning:

- i. What is the purpose of the Planning Phase for a project such as this?
- ii. What are the typical outcomes of the Planning Phase?
- iii. How did not doing this step affect Megan's project outcome?

B. Analysis:

- i. What is the purpose of the Analysis Phase?
- ii. What is the key outcome produced during the Analysis Phase?
- iii. In what ways do you think this project was hurt by not going through a typical Analysis Phase?

C. Design:

- i. What is the purpose of the Design Phase?
- ii. How do you think this project could have been improved by going through a typical Design Phase?
- iii. Do you think Megan's assistant and sales force members could have helped at all during the design phase? If so, how?

D. Implementation:

- i. What type of work is done in the Implementation Phase for a project like this?
- ii. What is usually done during the Implementation Phase to ensure that the users of the system are satisfied with it?
- iii. Megan's approach to "construction" was to throw something together and "tweak it around." How do you think that approach contributed to the problems she is now experiencing with her project?

Note: If using the flipped classroom model, students should study the SDLC material before class. Divide the class into four teams, assign each team one of the SDLC phases, and have each team present the question's answers to the rest of the class.

2. The Amberssen Specialty Company is a chain of 12 retail stores that sell a variety of imported gift items, gourmet chocolates, cheeses, and wines in the Toronto area. Amberssen has an IS staff of three people who have created a simple, but effective, IS of networked point-of-sale registers at the stores, and a centralized accounting system at the company headquarters. Harry Hilman, the head of Amberssen's IS group, has just received the following memo from Bill Amberssen, Sales Director (and son of Amberssen's founder):

Harry—It's time Amberssen Specialty launched itself on the Internet. Many of our competitors are already there, selling to customers without the expense of a retail storefront, and we should be there too. I project that we could double or triple our annual revenues by selling our products on the Internet. I'd like to have this ready by Thanksgiving, in time for the prime holiday gift-shopping season. Bill

After pondering this memo for several days, Harry scheduled a meeting with Bill so that he could clarify Bill's vision of this venture. Using the standard content of a system request as your guide, prepare a list of questions that Harry needs to have answered about this project.

Note: If using the flipped classroom model, students should study the System Request material before class. Divide the class into small groups. Each group should prepare a list of key questions. Then, compile a comprehensive list from all groups and have the class rank the questions in order of importance.

3. The Decker Company maintains a fleet of 10 service trucks and crew which provides a variety of plumbing, heating, and cooling repair services to residential customers. Currently, it takes on average about 6 hours before a service team responds to a service request. Each truck and crew averages 12 service calls per week, and the average revenue earned per service call is \$150. Each truck is in service 50 weeks per year. Due to the difficulty in scheduling and routing, there is considerable slack time for each truck and crew during a typical week.

Decker management is evaluating the purchase of a pre-written routing and scheduling software package. The benefits of the system will include reduced response time to service requests and more productive service teams, but management is having trouble quantifying these benefits.

One approach is to make an estimate of how much service response time will decrease with the new system, which

then can be used to project the increase in the number of service calls made each week. For example, if the system permits the average service response time to fall to 4 hours, the management believes that each truck will be able to make 16 service calls per week on average—an increase of 4 calls per week. With each truck making 4 additional calls per week and the average revenue per call at \$150, the revenue increase per truck per week is \$600($4 \times \150). With 10 trucks in service 50 weeks per year, the average annual revenue increase will be \$300,000($\$600 \times 10 \times 50$).

The Decker Company management is unsure whether the new system will enable response time to fall to 4 hours on average or will be some other number. Therefore, management has developed the following range of outcomes that may be possible outcomes of the new system, along with probability estimates of each outcome occurring:

New Response Time	# Calls/Truck/Week	Likelihood
2 hours	20	20%
3 hours	18	30%
4 hours	16	50%

Given these figures, prepare a spreadsheet model that computes the expected value of the annual revenues to be produced by this new system.

Martin is working to develop a preliminary cost-benefit analysis for a new client-server system. He has identified several cost factors and values for the new system, summarized in the following tables:

Development Costs—Personnel

2 Systems Analysts	400 hours/ea @ \$50/hour
4 Programmer Analysts	250 hours/ea @ \$35/hour
1 GUI Designer	200 hours/ea @ \$40/hour
1 Telecommunications Specialist	50 hours/ea @ \$50/hour
1 System Architect	100 hours/ea @ \$50/hour
1 Database Specialist	15 hours/ea @ \$45/hour
1 System Librarian	250 hours/ea @ \$15/hour

Development Costs—Training

4 Oracle training registration	\$3,500/student
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Development Costs—New Hardware and Software

1 Development server	\$18,700
1 Server software (OS, misc.)	\$1,500
1 DBMS server software	\$7,500
7 DBMS client software	\$950/client

**Annual Operating Costs—
Personnel**

2 Programmer Analysts	125 hours/ea @ \$35/hour
1 System Librarian	20 hours/ea @ \$15/hour

**Annual Operating Costs—
Hardware, Software, and Misc.**

1 Maintenance agreement for server	\$995
1 Maintenance agreement for server	\$525
DBMS software	
Preprinted forms	15,000/year @ \$.22/form

The benefits of the new system are expected to come from two sources: increased sales and lower inventory levels. Sales are expected to increase by \$30,000 in the first year of the system's operation and will grow at a rate of 10% each year thereafter. Savings from lower inventory levels are expected to be \$15,000 per year for each year of the project's life.

Using a format like the spreadsheets in this chapter, develop a spreadsheet that summarizes this project's cash flow, assuming a 4-year useful life after the project is developed. Compute the present value of the cash flows, using an interest rate of 9%.

What is the NPV for this project? What is the ROI for this project? What is the break-even point? Should this project be accepted by the approval committee?

APPENDIX 1A DETAILED ECONOMIC FEASIBILITY ANALYSIS FOR DRŌNTEQ

Figure 1A-1 contains the summary spreadsheet for the DrōnTeq Client Services project. As shown, Carmella's initial sales projections are used for the first year's revenues. Revenues are projected to grow 10% in the second year and 8% in the third year.

Cost projections are based on Jiang's assumptions about the time it will take to develop the system and the resources that will be required. Operating costs have a considerable new labor component because a new business unit is being created, requiring additional staff.⁵

Figure 1A-1 incorporates several of the financial analysis techniques we have discussed. The rows marked A and C summarize the annual benefits and costs, respectively. The row marked D shows the yearly net benefits (total benefits – total costs). The ROI calculation shows that this project is expected to return 43% on the investment, calculated by dividing the difference between total benefits in row A and total costs in row C by the total costs in row C.

Row E shows the cumulative cash flow for the project, and this is used to determine the breakeven point. As seen in Figure 1A-1, the project fully recovers its costs in the second year, since the cumulative net cash flow becomes positive in the second year. It takes about 0.27 of the second year before the costs are recovered.

The row marked B computes the present value of each year's total benefits, and the row marked F computes the present value of each year's total costs. A 9% required rate of return was used in these calculations. These values are used in the NPV calculation. The total present value of costs is subtracted from the total present value of benefits, and the result is \$675,818, indicating the strong financial viability of this investment.

This spreadsheet shows that this project can add significant business value even if the underlying assumptions prove to be overly optimistic.

⁵Some of the salary information may seem high to you. Keep in mind that most companies use a "full cost" model for estimating salary cost in which all benefits (e.g., health insurance, retirement, payroll taxes) are included in salaries when estimating costs.

	2022	2023	2024	2025	Total
Benefits					
Revenue from new pilot contracts and drone leases		357,500	393,250	424,710	1,175,460
Sales from drone flight service and data analysis		565,000	621,500	671,220	1,857,720
Ⓐ Total Benefits		922,500	1,014,750	1,095,930	3,033,180
Ⓑ Present Value Total Benefits		846,330	854,095	846,259	2,546,684
Development Costs					
Labor - Analysis and Design	300,000				300,000
Labor - Implementation	175,000				175,000
Office space and equipment	8,000				8,000
Software	25,000				25,000
Hardware	50,000				50,000
Total Development Costs	558,000				558,000
Operational Costs					
Labor - Webmaster		85,000	89,250	93,713	267,963
Labor - Network technician		60,000	63,000	66,150	189,150
Labor - Computer operations		50,000	52,500	55,125	157,625
Labor - Business manager		60,000	63,000	66,150	189,150
Labor - Assistant manager		45,000	47,250	49,613	141,863
Labor - IS maintenance developers (3)		120,000	126,000	132,300	378,300
Software upgrades		5,000	5,000	5,000	15,000
Software licenses		8,000	8,000	8,000	24,000
Hardware upgrades		10,000	10,000	10,000	30,000
User training and support		8,000	8,400	8,820	25,220
Additional ISP charges		15,000	15,750	16,538	47,288
Marketing expenses		30,000	31,500	33,075	94,575
Total Operational Costs		496,000	519,650	544,483	1,560,133
Ⓒ Total Costs	558,000	496,000	519,650	544,483	2,118,133
Ⓓ Total Benefits – Total Costs	–558,000	350,330	334,445	301,777	428,552
Ⓔ Cumulative New Cash Flow	–558,000	–207,670	126,775	428,552	
Ⓕ Present Value Total Costs	558,000	455,046	437,379	420,440	1,870,865
Return on Investment (ROI)	143%	(3,033,180 / 2,118,133)			
Break-Even Point	1.62 years	(Costs are fully recovered in the second year; [334,445 – 126,775] / 334.445)			
NPV (PV Total Benefits – PV Total Costs)	675,819				
Intangible Costs and Benefits	Intangible Cost: Effective drone flight service option may reduce the demand for actual drone sales Intangible Benefit: Enhanced competitive position through expansion of our drone brand into the drone flight service market				

FIGURE 1A-1 Economic feasibility analysis for DrōnTeq.