CHAPTER

22

Introduction to Systems Development and Systems Analysis

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Explain the five phases of the systems development life cycle, and discuss the people involved in systems development and the roles they play.
2. Explain the importance of systems development planning, and describe the types of plans and planning techniques used.
3. Discuss the various types of feasibility analysis, and calculate economic feasibility using capital budgeting techniques.
4. Explain why system changes trigger behavioral reactions, what form this resistance to change takes, and how to avoid or minimize the resulting problems.
5. Discuss the key issues, objectives, and steps in systems analysis.

INTEGRATIVE CASE Shoppers Mart

Ann Christy is the new controller of Shoppers Mart, a rapidly growing chain of discount stores. To assess how she can better serve Shoppers Mart, she held meetings with top management and visited with store managers and employees. Her findings are as follows:

1. Store managers cannot obtain information other than what is contained in periodic, preformatted reports. If they request information from several functional areas, the system bogs down.
2. Because timely information about product sales is not available, stores are often out of popular items and overstocked with products customers are not buying.
3. Management is concerned about losing market share to rivals with better prices and selection. The current system cannot provide the information management needs to solve this problem.

Ann is convinced that Shoppers Mart needs a new information system that is flexible, efficient, and responsive to user needs. Ann knows the new system will not be successful without management's complete support. Before asking for approval and funding for the new system, Ann met with systems development to ask the following questions:

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1. What process must be followed to obtain and implement a new system?
2. What planning is necessary to ensure the system's success? Who will be involved, and how? Do special committees need to be formed? What resources are needed? How should the planning be documented?
3. How will employees react to a new system? What problems might this change cause, and how can they be minimized?
4. How should the new system be "sold" to top management? How can expected costs and benefits be quantified to determine whether the system will be cost-effective?

Introduction

Because we live in a highly competitive and ever-changing world, at any given time most organizations are improving or replacing their information systems. It is estimated that each year corporate America spends more than $300 billion on more than 200,000 software projects. Companies change their systems for the following reasons:

- ***Changes in user or business needs.*** Increased competition, business growth or consolidation, downsizing operations, mergers and divestitures, or new regulations can alter an organization's structure and purpose. To remain responsive, the system must change.
- ***Technological changes.*** As technology advances and becomes less costly, organizations adopt new technologies. For example, a New York utility downsized from a mainframe to a client/server system and eliminated 100 clerical positions. The new system does much more than the old one, including handling workflow management, user contact, database queries, automatic cash processing, and voice/data integration.
- ***Improved business processes.*** Many companies change their systems to improve inefficient business processes. At Nashua, an office supply manufacturer, processing a customer's telephone order took up to two days because three separate systems had to be accessed. The new system requires three minutes.
- ***Competitive advantage.*** Companies invest heavily in technology to increase the quality, quantity, and speed of information; to improve products or services; to lower costs; and to provide other competitive advantages.
- ***Productivity gains.*** Information systems can automate clerical tasks, decrease task performance time, and provide employees with specialized knowledge. Carolina Power and Light eliminated 27% of its information systems staff with a system that significantly outperformed the old one.
- ***Systems integration.*** Organizations with incompatible systems integrate them to remove incompatibilities and to consolidate databases. The U.S. Department of Defense (DOD) is trying to integrate more than 700 separate systems.

- ***Systems age and need to be replaced.*** As systems age and are updated numerous times, they become less stable and eventually need to be replaced. Focus 22-1 describes how the Internal Revenue Service is trying to replace its aged information system.

Developing quality, error-free software is a difficult, expensive, and time-consuming task. Most software development projects deliver less, cost more, and take longer than expected. A study by Standish Group found that 70% of software development projects were late, 54% were over budget, 66% were unsuccessful, and 30% were canceled before completion. An American Management Systems study revealed that 75% of all large systems are not used, are not used as intended, or generate meaningless reports or inaccurate data. Nike implemented a forecasting system that did not work and had to take a multimillion-dollar inventory write-down. The system told Nike to order $90 million of shoes that did not sell, while it had $100 million of orders on popular models that it could not meet.

Skipping or skimping on systems development processes causes runaways that consume time and money and produces no usable results, as illustrated by the following examples:

- Pacific Gas & Electric pulled the plug on a system that was five years in development. It was a financial disaster with no usable product.
- When jeweler Shane Co. upgraded its enterprise resource planning (ERP) system, cost and deadline overruns pushed the cost from $10 million to more than $36 million and caused inventory problems that, combined with a faltering economy, resulted in bankruptcy.
- California's Department of Motor Vehicles attempted to overhaul its system. Developed in 1965, it was so difficult to maintain that it took 18 programmers working an entire year to add a Social Security number file to the drivers' license and vehicle registration system. After seven years, $44 million, and not a single usable application, the project was canceled.

This chapter discusses five topics. The first is the systems development life cycle, the process followed to obtain and implement a new accounting information system (AIS). The second is the planning activities needed during development. The third is preparing a feasibility analysis. The fourth is the behavioral aspects of change that must be dealt with to implement a new system. The fifth topic is systems analysis, the first step in the systems development life cycle.

FOCUS 22-1 The IRS Attempts to Replace Its Aging Information System

The IRS recognizes that it needs to modernize its 40-year-old system to provide better customer service, improve compliance with the nation's tax laws, and reduce the volume of paper tax returns. The system processes and stores all taxpayer records and takes in more than $2 trillion a year.

Critics claim the fragile and antiquated system has been updated so many times that a software meltdown is a very real possibility. In a worst-case scenario, the IRS would not know who had paid taxes, hundreds of billions of dollars of revenue would not be collected, and the government would have to borrow money to meet its obligations, throwing the financial markets into a panic.

The need to modernize is no secret; the IRS has been trying for some time. Years ago, the IRS spent $3.3 billion on an upgrade effort that failed. More recently, the IRS embarked on an $8 billion effort called the Business Systems Modernization (BSM) program. This program involves more than 20,000 major tasks and scores of organizations and is one of the largest and most complex information system challenges in history. At the same time, the IRS is trying to change its management culture and the way it is organized; some critics claim both are more out of date than its information system.

The IRS cannot change the entire system at once; instead, it will occur in stages over 15 to 20 years. The effort has been compared to rebuilding all New York City buildings, streets, sewers, and communication and transportation systems, all while its inhabitants do not notice the changes as they go about their daily lives.

How is the IRS doing? Reports are not encouraging. The BSM spent almost $4 million on a project that was canceled. The effort has had a number of significant cost overruns, management delays, performance shortfalls, and missed project completion dates. One report indicates the project runs a "significant risk of not succeeding."

Systems Development

This section discusses the systems development life cycle and the people involved in systems development.

THE SYSTEMS DEVELOPMENT LIFE CYCLE

Ann Christy asked the manager of systems development to explain the process Shoppers Mart uses to design and implement a new system. He sketched the five-step **systems development life cycle (SDLC)** shown in Figure 22-1 and briefly explained here.

systems development life cycle (SDLC) - A five-step process used to design and implement a new system.

systems analysis - First SDLC step where the information needed to purchase, develop, or modify a system is gathered.

SYSTEMS ANALYSIS The first step in systems development is **systems analysis**, where the information needed to purchase, develop, or modify a system is gathered. To better use limited resources, development requests are screened and prioritized. If a decision is made to move forward, the nature and scope of the proposed project is identified, the current system is surveyed to identify its strengths and weaknesses, and the feasibility of the proposed project is determined. If the proposed project is feasible, the information needs of system users and managers are identified and documented. These needs are used to develop and document the systems requirements used to select or develop a new system. A systems analysis report is prepared and submitted to the information systems steering committee.

conceptual design - Second SDLC step where analysts decide how to meet user needs, identify and evaluate design alternatives, and develop detailed specifications for what the system is to accomplish and how it is to be controlled.

CONCEPTUAL DESIGN During **conceptual design**, the company decides how to meet user needs. The first task is to identify and evaluate appropriate design alternatives, such as buying software, developing it in-house, or outsourcing system development to someone else. Detailed specifications outlining what the system is to accomplish and how it is to be controlled are developed. This phase is complete when conceptual design requirements are communicated to the information systems steering committee.

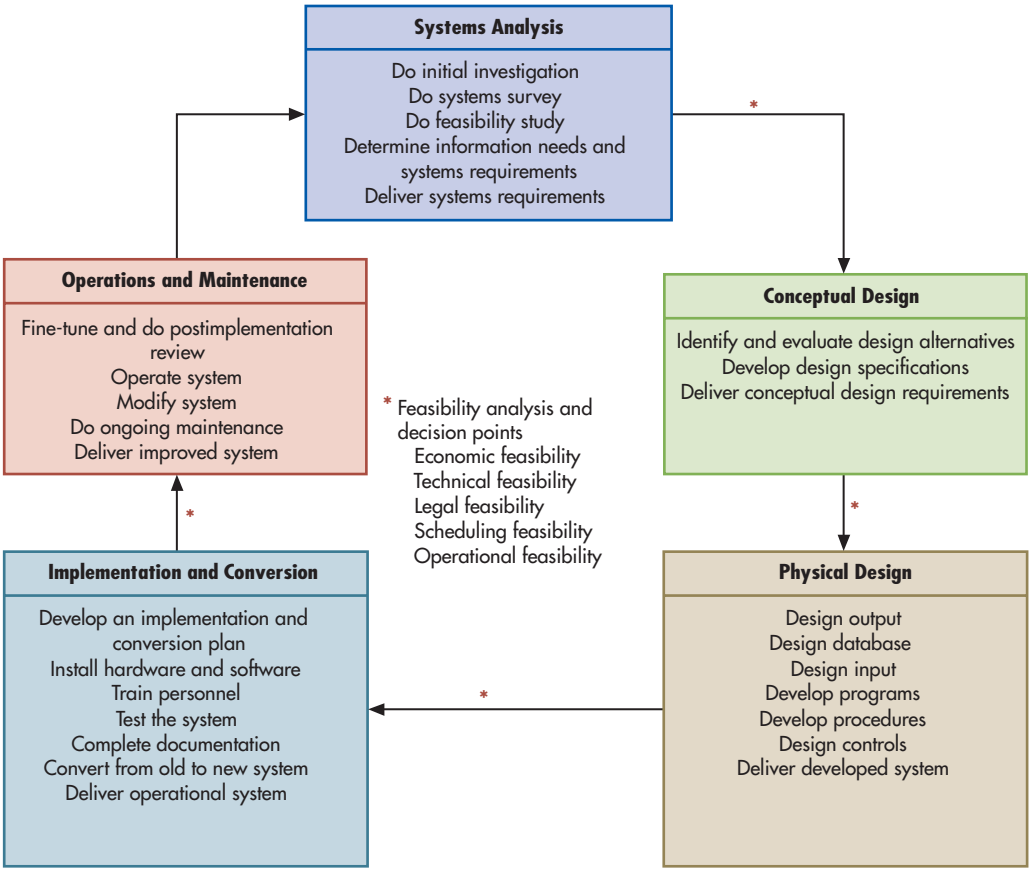

FIGURE 22-1
The Systems Development Life Cycle

Throughout the life cycle, planning must be done and behavioral aspects of change must be considered.

physical design - Third SDLC step where broad, user-oriented conceptual design requirements are translated into the detailed specifications used to code and test software, design input/output, create files/databases, develop procedures, and implement controls.

PHYSICAL DESIGN During **physical design**, the company translates the broad, user-oriented conceptual design requirements into the detailed specifications used to code and test computer programs, design input and output documents, create files and databases, develop procedures, and build controls into the new system. This phase is complete when the results of the physical system design are communicated to the information systems steering committee.

implementation and conversion - Fourth SDLC step where the company hires and trains employees, tests and modifies procedures, establishes standards and controls, completes documentation, moves to the new system, and detects and corrects design deficiencies.

IMPLEMENTATION AND CONVERSION All the elements and activities of the system come together in the **implementation and conversion** phase. An implementation and conversion plan is developed and followed, new hardware and software are installed and tested, employees are hired and trained or existing employees relocated, and processing procedures are tested and modified. Standards and controls for the new system are established and system documentation completed. The organization converts to the new system and dismantles the old one, makes needed adjustments, and conducts a postimplementation review to detect and correct design deficiencies. When the operational system is delivered, system development is complete. A final report is prepared and sent to the information systems steering committee.

operations and maintenance - Fifth SDLC step where the system is periodically reviewed and necessary modifications and improvements are made.

OPERATIONS AND MAINTENANCE During **operations and maintenance**, the new system is periodically reviewed and modifications are made as problems arise or as new needs become evident. Eventually, a major modification or system replacement is necessary, and the SDLC begins again.

In addition to these five phases, three activities (planning, managing behavioral reactions to change, and assessing the ongoing feasibility of the project) are performed throughout the life cycle. These three activities, as well as systems analysis, are discussed in this chapter. The different approaches to obtaining an AIS are discussed in Chapter 23. The last four SDLC phases are explained in Chapter 24.

THE PLAYERS

A number of people must cooperate to successfully develop and implement an AIS.

MANAGEMENT Management's most important systems development roles are to emphasize the importance of involving users in the process, to provide support and encouragement for development projects, and to align systems with corporate strategies. Other key roles include establishing system goals and objectives, selecting system department leadership and reviewing their performance, establishing policies for project selection and organizational structure, and participating in important system decisions. User management determines information requirements, assists analysts with cost and benefit estimates, assigns staff to development projects, and allocates funds for development and operation.

USERS AIS users communicate their information needs to system developers. As project development team or steering committee members, they help manage systems development. As requested, accountants help design, test, and audit the controls that ensure the accurate and complete processing of data. Control issues are discussed in depth in Chapters 8 through 13.

information systems steering committee - High-level management who plan and oversee the IS function, setting IS policies that govern the AIS, ensuring top-management guidance and control, and coordinating and integrating systems activities.

INFORMATION SYSTEMS STEERING COMMITTEE An executive-level **information systems steering committee** plans and oversees the information systems function. It consists of high-level management, such as the controller and systems and user-department management. The steering committee sets AIS policies; ensures top-management participation, guidance, and control; and facilitates the coordination and integration of systems activities.

PROJECT DEVELOPMENT TEAM Each development project has a team of systems analysts and specialists, managers, accountants, and users to guide its development. Team members plan each project, monitor it to ensure timely and cost-effective completion, make sure proper consideration is given to the human element, and communicate project status to top management and the steering committee. They should communicate frequently with users and hold regular meetings to consider ideas and discuss progress so that there are no surprises upon project completion. A team approach usually produces better results and facilitates user acceptance of the system.

SYSTEMS ANALYSTS AND PROGRAMMERS **Systems analysts** help users determine their information needs, study existing systems and design new ones, and prepare the specifications used by computer programmers. Analysts interact with employees throughout the organization to bridge the gap between the user and technology. Analysts are responsible for ensuring that the system meets user needs.

systems analysts - People who help users determine their information needs, study existing systems and design new ones, and prepare specifications used by computer programmers.

Computer programmers write and test programs using the specifications developed by systems analysts. They also modify and maintain existing computer programs.

computer programmers - People who write and test programs using the specifications developed by the analysts and modify and maintain existing computer programs.

EXTERNAL PLAYERS Customers, vendors, external auditors, and governmental entities play a role in systems development. For example, Walmart vendors are required to implement and use electronic data interchange (EDI).

Planning Systems Development

This section discusses the planning performed throughout the SDLC (see Figure 22-1).

Imagine that you built a two-bedroom house. Over the years, you add two bedrooms, a bathroom, a family room, a recreation room, a deck, and a two-car garage, and you expand the kitchen. Without a long-range plan, your house will end up as a poorly organized and costly patchwork of rooms surrounding the original structure. This scenario also applies to an AIS; the result is a costly and poorly integrated system that is difficult to operate and maintain.

Planning has distinct advantages. It enables the system's goals and objectives to correspond to the organization's overall strategic plan. Systems are more efficient, subsystems are coordinated, and there is a sound basis for selecting new applications for development. The company remains abreast of the ever-present changes in information technology (IT). Duplication, wasted effort, and cost and time overruns are avoided. The system is less costly and easier to maintain. Finally, management is prepared for resource needs, and employees are prepared for the changes that will occur.

When development is poorly planned, a company must often return to a prior phase and correct errors and design flaws, as shown in Figure 22-2. This is costly and results in delays, frustration, and low morale.

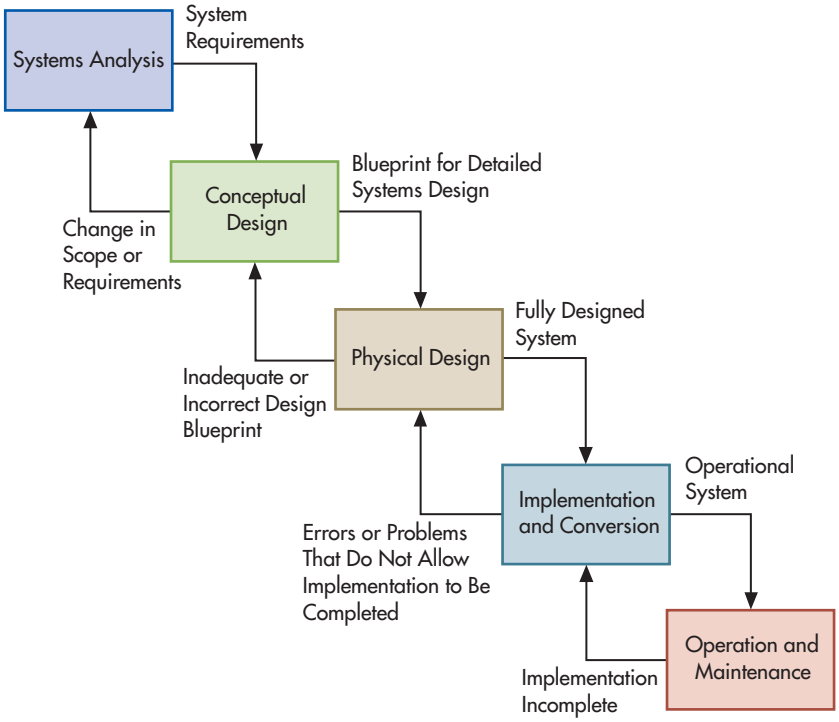

FIGURE 22-2
Reasons for Returning to a Prior SDLC Phase

project development plan - Document showing project requirements (people, hardware, software, and financial), a cost–benefit analysis, and how a project will be completed (modules or tasks to be performed, who will perform them, and completion dates).

master plan - Describes what a system will consist of, how it will be developed, who will develop it, when it will be developed, how needed resources will be acquired, the status of projects in process, the prioritization of planned projects, and the prioritization criteria.

Two systems development plans are needed:

1. ***Project development plan.*** A **project development plan**, prepared by the project team, contains a cost–benefit analysis, developmental and operational requirements (people, hardware, software, and financial), and a schedule of the activities required to develop and operate the new application.
2. ***Master plan.*** A long-range **master plan**, prepared by the information systems steering committee, specifies what the system will consist of, how it will be developed, who will develop it, how needed resources will be acquired, and where the AIS is headed. It describes the status of projects in process, prioritizes planned projects, describes the criteria used for prioritization, and provides development timetables. Projects with the highest priority are developed first. A three-year planning horizon is common, with the plan updated quarterly or monthly. Table 22-1 shows the master plan components at Shoppers Mart.

As explained in Focus 22-2, inadequate planning was one reason why Electronic Data Systems (EDS) lost a significant amount of money in its contract with the U.S. military.

TABLE 22-1 Components of the Master Plan at Shoppers Mart

- Organizational Goals and Objectives
  - Company mission statement and goals
  - Information systems strategic plan and goals
  - Organizational constraints
  - Organizational approach to AIS
  - Organizational and AIS priorities
- Inventory and Assessments
  - Current systems
  - Approved systems
  - Current hardware
  - Current software
  - Current AIS staff
  - Assessment of strengths and weaknesses
- Status of Systems Being Developed
  - Proposed systems priorities
  - Approved systems development
  - Proposals under consideration
  - Development timetables and schedules
- Forecast of Future Developments
  - Forecasts of information needs
  - Technological forecasts
  - Environmental/regulatory forecasts
  - Audit and control requirements
  - External user needs

FOCUS 22-2 EDS Loses Billions in Its Contract with the Navy

The U.S. military hired Electronic Data Systems (EDS) to develop a secure network to link 350,000 computers at 4,000 Navy sites. The $10 billion contract resulted in significant headaches and estimated losses of $1.7 billion. EDS made the following mistakes:

- With little military experience, EDS did not plan for their delays and requests. Congress delayed the project for 18 months by asking for network-performance tests EDS was not used to handling. EDS also failed to plan for the 200 technical hurdles the military imposed.
- EDS did not verify Navy estimates, such as the 5,000 software programs to be installed on the new PCs; in reality, there were 67,000. EDS underestimated cost and time requirements to customize individual computers. They also had to revamp the Navy's old software before it could be installed.
- EDS did not plan and coordinate project tasks. When EDS went to Navy bases to install the computers, they did not have proper military clearances and some sailors and officers were busy or overseas.
- EDS did not give the Navy adequate instructions.
- EDS could not complete an order without a service member's rank, but EDS did not tell the Navy to send the rank.
- EDS did not track computer inventory. Some servicemen ordered PCs and then changed their orders to laptops. EDS did not require them to cancel the first order, so two computers were prepared. Duplicate and incomplete orders sat in warehouses for months.

To get the project back on track, EDS made some changes. Rather than installing computers at many different locations simultaneously, it installed computers at the largest bases first, reused expensive hardware, installed the warehoused computers before buying new ones, and customized computers by job function rather than by individual.

PLANNING TECHNIQUES

PERT and Gantt charts are techniques for scheduling and monitoring systems development activities. The **program evaluation and review technique (PERT)** requires that all activities and the precedent and subsequent relationships among them be identified. The activities and relationships are used to draw a PERT diagram, which is a network of arrows and nodes representing project activities that require an expenditure of time and resources and the completion and initiation of activities. Completion time estimates are made, and the **critical path**—the path requiring the greatest amount of time—is determined. If any activity on the critical path is delayed, then the whole project is delayed. If possible, resources can be shifted to critical path activities to reduce project completion time.

program evaluation and review technique (PERT) - A way to plan, develop, coordinate, control, and schedule systems development activities; all activities, and precedent and subsequent relationships among activities, are identified and shown on a PERT diagram.

critical path - The PERT path requiring the greatest amount of time to complete a project; if a critical path activity is delayed, the whole project is delayed.

A **Gantt chart** (Figure 22-3) is a bar chart with project activities on the left-hand side and units of time across the top. For each activity, a bar is drawn from the scheduled starting date to the ending date, thereby defining expected project completion time. As activities are completed, they are recorded on the Gantt chart by filling in the bar; thus, at any time it is possible to determine which activities are on schedule and which are behind. The primary advantage of the Gantt chart is the ability to show graphically the entire schedule for a large, complex project, including progress to date and status. A disadvantage is that the charts do not show the relationships among project activities.

Gantt chart - A bar graph used for project planning. It shows project activities on the left, units of time across the top, and the time each activity is expected to take as a horizontal bar.

Feasibility Analysis

As shown in Figure 22-1, a **feasibility study** (or business case) is prepared during systems analysis and updated as necessary during the SDLC. The extent varies; for a large-scale system, it is generally extensive, whereas one for a desktop system might be informal. The feasibility study is prepared with input from management, accountants, systems personnel, and users.

feasibility study - An investigation to determine whether it is practical to develop a new application or system.

At major decision points, the steering committee reassess feasibility to decide whether to terminate a project, proceed unconditionally, or proceed if specific problems are resolved. Early go/no-go decisions are particularly important because each subsequent SDLC step requires more time and monetary commitments. The further along a development project is, the less likely it is to be canceled if a proper feasibility study has been prepared and updated.

Although uncommon, systems have been scrapped after implementation because they did not work or failed to meet an organization's needs. Bank of America, for example, hired a software firm to replace a 20-year-old system used to manage billions of dollars in institutional trust accounts. After two years of development, the new system was implemented despite warnings that it was not adequately tested. Ten months later the system was scrapped, top executives resigned, and the company took a $60 million write-off. The company lost

PROJECT PLANNING CHART

Project Number 01 - 650
Project Name Labor Cost Analysis Module
Project Leader J. Flaherty

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Prepared by S. Doe
Date 12 / 09 / 2021

ACTIVITY		WEEK STARTING																												
No.	Name	11/17	11/24	12/1	12/8	12/15	12/22	12/29	1/5	1/12	1/19	1/26	2/2	2/9	2/16	2/23	3/2	3/9	3/16	3/23	3/30									
1-1	Organize implementation team																													
1-2	Prepare system support procedures																													
1-3	Develop conversion plan																													
1-4	Develop testing plan																													
2-1	Prepare program specifications																													
2-2	Revise system documentation																													
2-3	Perform programming tasks																													
3-1	System test																													
4-1	Install system support procedures																													
5-1	Acceptance test																													
6-1	Conversion																													

FIGURE 22-3
Sample Gantt Chart

100 institutional accounts with $4 billion in assets. Focus 22-3 describes a Blue Cross/Blue Shield project that was scrapped after six years and a $120 million investment.

There are five important aspects to be considered during a feasibility study:

economic feasibility - Determining whether system benefits justify the time, money, and resources required to implement it.

technical feasibility - Determining if a proposed system can be developed given the available technology.

legal feasibility - Determining if a proposed system will comply with all applicable federal and state laws, administrative agency regulations, and contractual obligations.

scheduling feasibility - Determining if a proposed system can be developed and implemented in the time allotted.

operational feasibility - Determining if the organization has access to people who can design, implement, and operate the proposed system and if employees will use the system.

1. ***Economic feasibility.*** Will system benefits justify the time, money, and resources required to implement it?
2. ***Technical feasibility.*** Can the system be developed and implemented using existing technology?
3. ***Legal feasibility.*** Does the system comply with all applicable federal and state laws, administrative agency regulations, and contractual obligations?
4. ***Scheduling feasibility.*** Can the system be developed and implemented in the time allotted?
5. ***Operational feasibility.*** Does the organization have access to people who can design, implement, and operate the proposed system? Will people use the system?

Economic feasibility is now discussed in greater depth. Ann's feasibility analysis for Shoppers Mart is shown in Table 22-8 at the end of this chapter.

CAPITAL BUDGETING: CALCULATING ECONOMIC FEASIBILITY

During systems design, alternative approaches to meeting system requirements are developed. Too often, companies overspend on technology because IT costs and payoffs are not measured and evaluated like other corporate investments. Merrill Lynch overcame significant philosophical and bureaucratic obstacles to implement a return-on-investment program for IT expenditures. Merrill Lynch now requires a 15% cash return on equity investment within five years, and all IT purchases are made by business, finance, and IT professionals working together.

Many organizations now use capital budgeting return-on-investment techniques to evaluate the economic merits of the alternatives. In a **capital budgeting model**, benefits and costs are estimated and compared to determine whether the system is cost beneficial. Benefits and costs not easily quantifiable are estimated and included. If they cannot be accurately estimated, they are listed, and their likelihood and expected impact on the organization evaluated. Tangible and intangible benefits include cost savings, improved customer service, productivity increases, improved data processing, better decision making, greater management control, increased job satisfaction, and increased employee morale. Initial outlay and operating costs are shown in Table 22-2. Between 65% and 75% of yearly systems-related expenditures are for maintaining current systems.

capital budgeting model - A return-on-investment technique used to compare estimated benefits and costs to determine whether a system is cost beneficial.

FOCUS 22-3 Blue Cross/Blue Shield Abandons Runaway

Blue Cross/Blue Shield of Massachusetts had high hopes for its new information system. After six years and $120 million, however, the System 21 project was behind schedule and way over budget.

Although system failures of this magnitude are unusual, KPMG found that 35% of major information system projects become a runaway—a project millions of dollars over budget and months or years behind schedule. Other surveys show that almost every Fortune 200 company has had at least one runaway.

One reason for the problems was that Blue Cross hired an independent contractor to develop the software but neglected to appoint an in-house person to coordinate and manage the project. Nor did management establish a firm set of priorities regarding essential features and the sequence of application development.

The developers presented claims processing software to Blue Cross, but managers and users were not happy and requested numerous changes. As a result, the whole project was delayed. This led to ever-increasing cost overruns. By the time System 21 was launched, Blue Cross had fallen far behind its competitors' ability to process an ever-swelling paperwork load. During the six-year period, it lost 1 million subscribers and came close to bankruptcy.

Blue Cross learned a painful lesson. It abandoned the system it spent six years building and turned its hardware over to EDS. Fortunately, although the system died, the patient survived.

TABLE 22-2 Initial Outlay and Operating Costs

Hardware
- Central processing unit
- Peripherals
- Communications hardware
- Special input/output devices
- Replacement, upgrade, expansion costs

Software
- Application, system, general-purpose, utility, and communications software
- Updated versions of software
- Application software design, programming, modification, testing, and documentation

Staff
- Supervisors
- Analysts and programmers
- Computer operators
- Input (data conversion) personnel
- Hiring, training, and relocating staff
- Consultants

Supplies and Overhead
- Preprinted forms
- Data storage devices
- Supplies (paper, toner)
- Utilities and power

Maintenance/Backup
- Hardware/software maintenance
- Backup and recovery operations
- Power supply protection

Documentation
- Systems documentation
- Training program documentation
- Operating standards and procedures

Site Preparation
- Air-conditioning, humidity, dust controls
- Physical security (access)
- Fire and water protection
- Cabling, wiring, and outlets
- Furnishings and fixtures

Installation
- Freight and delivery charges
- Setup and connection fees

Conversion
- Systems testing
- File and data conversions
- Parallel operations

Financial
- Finance charges
- Legal fees
- Insurance

The following are three commonly used capital budgeting techniques:

1. ***Payback period.*** The **payback period** is the number of years required for the net savings to equal the initial cost of the investment. The project with the shortest payback period is usually selected.
2. ***Net present value (NPV).*** All estimated future cash flows are discounted back to the present, using a discount rate that reflects the time value of money. The initial outlay costs are deducted from the discounted cash flows to obtain the **net present value (NPV)**. A positive NPV indicates the alternative is economically feasible. The highest positive NPV is usually selected.
3. ***Internal rate of return (IRR).*** The **internal rate of return (IRR)** is the effective interest rate that results in an NPV of zero. A project's IRR is compared with a minimum acceptable rate to determine acceptance or rejection. The proposal with the highest IRR is usually selected.

Payback, NPV, and IRR are illustrated in the feasibility analysis shown in Table 22-8.

payback period - A return-on-investment technique used to calculate the number of years required for the net savings of a system to equal its initial cost.

net present value (NPV) - A return-on-investment technique that discounts all estimated future cash flows back to the present using a discount rate that reflects the time value of money.

internal rate of return (IRR) - A return-on-investment technique that calculates the interest rate that makes the present value of total costs equal to the present value of total savings.

Behavioral Aspects of Change

Individuals participating in systems development are change agents who are continually confronted by resistance to change. The **behavioral aspects of change** are crucial because the best system will fail without the support of the people it serves. Niccolo Machiavelli discussed resistance to change more than 400 years ago:

behavioral aspects of change - The positive and negative ways people react to change; managing these behavioral reactions is crucial to successfully implementing a new system.

> *It must be considered that there is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things. For the reformer has enemies in all those who could profit by the old order, and only lukewarm defenders in all those who could profit by the new order. This*

lukewarmness arises partly from fear of their adversaries, who have the laws in their favor, and partly from the incredulity of mankind, who do not truly believe in anything new until they have had an actual experience of it.[1]

Organizations must be sensitive to and consider the feelings and reactions of persons affected by change. This section discusses the type of behavioral problems that can result from change.

WHY BEHAVIORAL PROBLEMS OCCUR

An individual's view of change, as either good or bad, usually depends on how that individual is personally affected by it. Management views change positively if it increases profits or reduces costs. Employees view the same change as bad if their jobs are terminated or adversely affected.

To minimize adverse behavioral reactions, one must understand why resistance takes place. Some of the more important factors include the following:

- ***Fear.*** People fear the unknown, losing their jobs, losing respect or status, failure, technology and automation, and the uncertainty accompanying change.
- ***Top-management support.*** Employees who sense a lack of top-management support for change wonder why they should endorse it.
- ***Experience with prior changes.*** Employees who had a bad experience with prior changes are more reluctant to cooperate.
- ***Communication.*** Employees are unlikely to support a change unless the reasons behind it are explained.
- ***Disruptive nature of change.*** Requests for information and interviews are distracting and place additional burdens on people, causing negative feelings toward the change that prompted them.
- ***How change is introduced.*** Resistance is often a reaction to the methods of instituting change rather than to change itself. The rationale used to sell the system to top management may not be appropriate for lower-level employees. The elimination of menial tasks and the ability to advance and grow are often more important to users than increasing profits and reducing costs.
- ***Biases and emotions.*** People with emotional attachments to their duties or coworkers may not want to change if those elements are affected.
- ***Personal characteristics and background.*** Generally speaking, the younger and more highly educated people are, the more likely they are to accept change. Likewise, the more comfortable people are with technology, the less likely they are to oppose changes.

HOW PEOPLE RESIST CHANGE

Behavioral problems begin when people find out a change is being considered. Initial resistance is often subtle, manifested by failure to provide developers with information, tardiness, or subpar performance. Major behavioral problems often occur when the new system is implemented and the change becomes a reality. Focus 22-4 explains the resistance the DOD experienced.

Resistance often takes one of three forms: aggression, projection, or avoidance.

aggression - Resistance to change intended to destroy, cripple, or weaken system effectiveness, such as increased error rates, disruptions, or deliberate sabotage.

AGGRESSION **Aggression** is behavior that destroys, cripples, or weakens system effectiveness, such as increased error rates, disruptions, or deliberate sabotage. After one organization introduced an online AIS, data input devices had honey poured on them, were run over by forklifts, or had paper clips inserted in them. Employees also entered erroneous data into the system. In another organization, disgruntled workers punched in to an unpopular supervisor's department and worked in other areas. This adversely affected the supervisor's performance evaluation because he was charged for hours that did not belong to him.

projection - Resistance to change that blames anything and everything on the new system, such that it becomes the scapegoat for all real and imagined problems and errors.

PROJECTION **Projection** is blaming the new system for everything that goes wrong. The system becomes the scapegoat for all real and imagined problems and errors. If these criticisms are not controlled or answered, system integrity can be damaged or destroyed.

[1] Niccolo Machiavelli, *The Prince*, translated by Luigi Rice, revised by E.R.P. Vincent (New York: New American Library, 1952).

FOCUS 22-4 Resistance to Change at the Department of Defense

The U.S. Department of Defense (DOD) has a budget of $417 billion, 3.3 million employees, and more than $1 trillion in assets. It also has one of the most antiquated and inefficient information systems in the world and cannot produce accurate accounting information or get a clean audit. Only a few of their 4,000 systems communicate effectively with other systems. Most systems require data that are transferred between systems to be manually reentered.

The DOD has been trying to modernize its AIS for more than 20 years, at a cost of more than $35 billion. After three notable failures, it is trying a fourth time. The Business Management Modernization Project's (BMMP) goal is to integrate DOD systems and business processes and produce a user-transparent system. Unfortunately, many people would rather not see the DOD realize this transparency. Past reforms failed because system developers could not break through the barriers DOD agencies created to protect their processes, procedures, and chains of command.

Users resist integration because what is optimal for one user is often suboptimal for the DOD. Government bureaucrats resist because an integrated, transparent system will reveal many unnecessary or obsolete programs that further personal agendas. For example, managers are often promoted for their ability to generate, receive funding for, and operate programs, regardless of their effectiveness. Senators and congressional representatives resist because a new system could adversely affect their ability to steer spending to constituents and thereby get reelected.

To overcome these behavioral problems, the DOD is trying to convince the armed forces to rid themselves of their "program protection" mindset. In one notable success, the Air Force now promotes personnel based on actions that improve the Air Force as a whole, rather than on actions that defend a specific turf or program.

AVOIDANCE **Avoidance** is ignoring a new AIS in the hope that the problem (the system) will eventually go away. Davis Controls, a struggling manufacturer, processed its orders using e-mail, but pertinent information was frequently lost or forgotten. Davis invested $300,000 in software that efficiently captured customer information, properly handled purchase orders, helped managers make better daily decisions, and made it possible to process four times as many transactions. Employees avoided it, even though the CEO explained the system's benefits and told them the company's survival and their jobs were at stake. Finally, the CEO disabled the uncooperative employees' e-mail accounts and terminated the employees who continued to avoid the system.

avoidance - Resistance to change where users ignore a new IS in the hope that the new system will eventually go away.

PREVENTING BEHAVIORAL PROBLEMS

The human element, which is often the most significant problem a company encounters in implementing a system, can be improved by observing the following guidelines:

- ***Obtain management support.*** Appoint a champion who can provide resources and motivate others to assist and cooperate with systems development.
- ***Meet user needs.*** It is essential that the system satisfy user needs.
- ***Involve users.*** Those affected by the system should participate in its development by making suggestions and helping make decisions. To avoid misunderstandings, users should be told which suggestions are being used and how, and which are not and why. Participation is ego enhancing, challenging, and intrinsically satisfying. Users who participate in development are more knowledgeable, better trained, and more committed to using the system.
- ***Allay fears, and stress new opportunities.*** Users are vitally interested in how system changes affect them personally. Address their concerns and provide assurances (to the extent possible) that job losses and responsibility shifts will not occur—for example, through relocation, attrition, and early retirement. If employees are terminated, provide severance pay and outplacement services. Emphasize that the system may provide advancement opportunities and greater job satisfaction because the job has become more interesting and challenging.

- ***Avoid emotionalism.*** When logic vies with emotion, it rarely stands a chance. Emotional issues should be allowed to cool, they should be handled in a nonconfrontational manner, or they should be sidestepped.
- ***Provide training.*** Effective use and support are not possible if users do not understand the system. User training needs are often underestimated.
- ***Reexamine performance evaluation.*** Performance standards and criteria should be reevaluated to ensure that they are congruent with the new system.
- ***Keep communication lines open.*** Everyone affected by systems development should have an attitude of trust and cooperation. If employees become hostile, it is difficult to change their attitude and to implement the system. As soon as possible, employees should be told what changes are being made and why and be shown how the new system benefits them. This helps employees identify with the company's efforts and feel they are key players in the company's future goals and plans. It also helps prevent rumors and misunderstandings. Employees should be told whom they can contact if they have questions or concerns.
- ***Test the system.*** The system should be properly tested prior to implementation to minimize initial bad impressions.
- ***Keep the system simple, and humanize it.*** Avoid complex systems that cause radical changes. Make the change as simple as possible by conforming to existing organizational procedures. The new system is unlikely to be accepted if individuals believe the computer is controlling them or has usurped their positions.
- ***Control users' expectations.*** A system is sold too well if users have unrealistic expectations of its capabilities and performance. Be realistic when describing the merits of the system.

These guidelines are time-consuming and expensive, and workers may skip them to speed systems development and installation. However, the problems caused by not following the guidelines are usually more expensive and time-consuming to fix than to prevent.

Systems Analysis

request for systems development - A written request for a new or improved system that describes the current system's problems, the reasons for the change, and the proposed system's objectives, benefits, and costs.

When a new or improved system is needed, a written **request for systems development** is prepared. The request describes the current problems, the reasons for the change, the proposed system's objectives, and its anticipated benefits and costs. The five steps in the analysis phase and their objectives are shown in Figure 22-4 and discussed in this section.

INITIAL INVESTIGATION

initial investigation - A preliminary investigation to determine whether a proposed new system is both needed and feasible.

An **initial investigation** is conducted to screen the requests for systems development. The exact nature of the problem(s) must be determined. In some instances, the perceived problem is not the real problem. A government accountant once asked a consultant to develop an AIS to produce the information he needed regarding fund expenditures and available funds. An investigation showed that the system provided the information, and he did not understand the reports he received.

The project's scope (what it should and should not accomplish) is determined. Scope creep (adding additional requirements to the scope after it has been agreed to) is a real problem. Because of scope creep, a plan to have Census Bureau employees compile and transmit 2010 census information to headquarters with handheld computers was scrapped after two years of work. After spending $595 million on handhelds, the Census Bureau reverted back to pen-and-paper census taking.

A new AIS is useful when problems result from lack of information, inaccessibility of data, and inefficient data processing. A new AIS is not the answer to organizational problems. Likewise, if a manager lacks organizational skills, or if failure to enforce existing procedures causes control problems, a new AIS is not the answer. The initial investigation should also

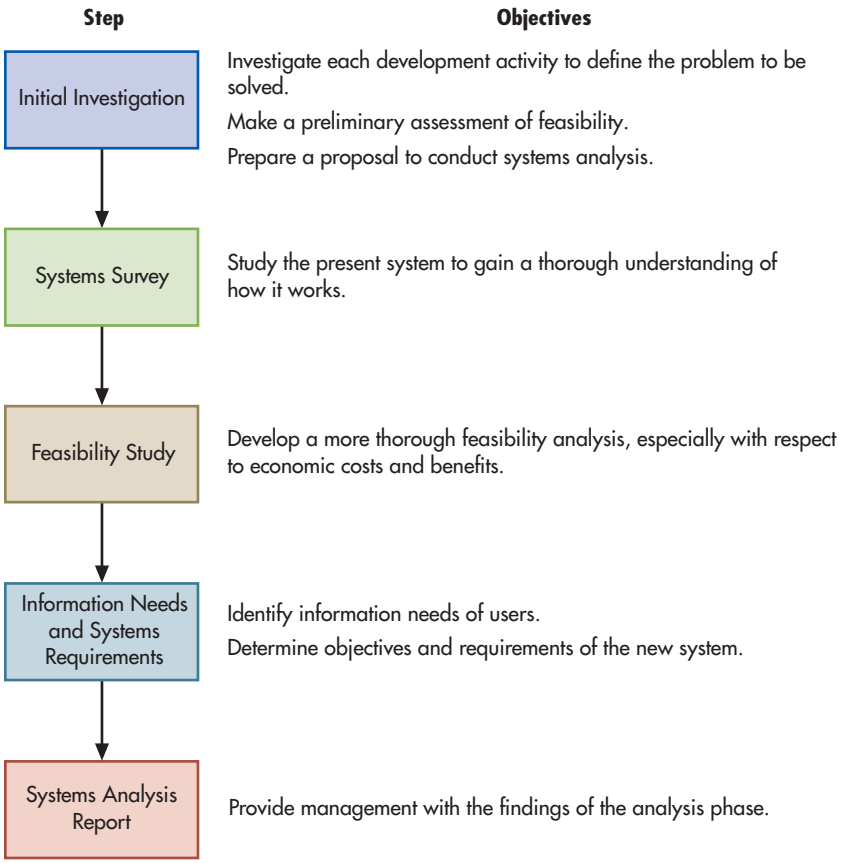

FIGURE 22-4
Steps in Systems Analysis

determine a project's viability and preliminary costs and benefits, and it should recommend whether to initiate the project as proposed, modify it, or abandon it.

A **proposal to conduct systems analysis** is prepared for approved projects. The project is assigned a priority and added to the master plan. Table 22-3 shows the information contents of a proposal to conduct systems analysis.

proposal to conduct systems analysis - A request to complete the systems analysis phase for a project that makes it through the initial investigation.

TABLE 22-3 Table of Contents for Reports Prepared During Systems Analysis at Shoppers Mart

Proposal to Conduct Systems Analysis

Table of Contents

i. Executive Summary
ii. System Problems and Opportunities
iii. Goals and Objectives of Proposed System
iv. Project Scope
v. Anticipated Costs and Benefits
vi. Participants in Development Project
vii. Proposed System Development Tasks and Work Plan
viii. Recommendations

Systems Survey Report

Table of Contents

i. Executive Summary
ii. System Goals and Objectives
iii. System Problems and Opportunities
iv. Current System Operations
  A. Policies, Procedures, and Practices Affecting System
  B. System Design and Operation (Intended and Actual)
  C. System Users and Their Responsibilities
  D. System Outputs, Inputs, and Data Storage
  E. System Controls
  F. System Strengths, Weaknesses, and Constraints
  G. Costs to Operate System
v. User Requirements Identified

Systems Analysis Report

Table of Contents

i. Executive Summary
ii. System Goals and Objectives
iii. System Problems and Opportunities
iv. Project Scope
v. Relationship of Project to Overall Strategic Information Systems Plan
vi. Current System Operations
vii. User Requirements
viii. Feasibility Analysis
ix. System Constraints
x. Recommendations for New System
xi. Proposed Project Participants and Work Plan
xii. Summary
xiii. Approvals
xiv. Appendix of Documents, Tables, Charts, Glossary

SYSTEMS SURVEY

systems survey - An extensive study of the current AIS.

A **systems survey** is an extensive study of the current AIS that has the following objectives:

- Gain an understanding of company operations, policies, procedures, and information flow; AIS strengths and weaknesses; and available hardware, software, and personnel.
- Make preliminary assessments of current and future processing needs, and determine the extent and nature of the changes needed.
- Develop working relationships with users, and build support for the AIS.
- Collect data that identify user needs, conduct a feasibility analysis, and make recommendations to management.

Data about the current AIS is gathered from employees and from documentation such as organizational charts and procedure manuals. External sources include consultants, customers and suppliers, industry associations, and government agencies. The advantages and disadvantages of four common methods of gathering data are summarized here and in Table 22-4.

An *interview* gathers answers to "why" questions. Care must be taken to ensure that personal biases, self-interest, or a desire to say what the employee thinks the interviewer wants to hear does not produce inaccurate information. Ann's Shoppers Mart interviews were successful because of her approach and preparation. For each interview, Ann made an appointment, explained the purpose beforehand, indicated the amount of time needed, and arrived on time. Before each session, Ann studied the interviewee's responsibilities and listed points she wanted to cover. Ann put each interviewee at ease by being friendly, courteous, and tactful. Her questions dealt with the person's responsibilities, how she interacted with the AIS, how the system might be improved, and the person's information needs. Ann let the interviewee do most of the talking and paid special attention to nonverbal communication because subtle overtones and body language can be as significant as direct responses to questions. Ann took notes, augmented them with detailed impressions shortly after the interview, and asked permission to tape especially important interviews.

Questionnaires are used when the amount of information to be gathered is small and well defined, is obtained from many people or from those who are located elsewhere, or is intended to verify data from other sources. Questionnaires take relatively little time to administer, but developing a quality questionnaire can be challenging and requires significant time and effort.

TABLE 22-4 Advantages and Disadvantages of Data-Gathering Methods

	Advantages	Disadvantages
Interviews	Can answer "why" questions Interviewer can probe and follow up Questions can be clarified Builds positive relationships with interviewee Builds acceptance and support for new system	Time-consuming Expensive Personal biases or self-interest may produce inaccurate information
Questionnaires	Can be anonymous Not time-consuming Inexpensive Allows more time to think about responses	Does not allow in-depth questions or answers Cannot follow up on responses Questions cannot be clarified Impersonal; does not build relationships Difficult to develop Often ignored or completed superficially
Observation	Can verify how system actually works, rather than how it should work Results in greater understanding of the system	Time-consuming Expensive Difficult to interpret properly Observed people may alter behavior
Systems Documentation	Describes how system should work Written form facilitates review, analysis	Time-consuming May not be available or easy to find

Observation is used to verify information gathered using other approaches and to determine how a system actually works, rather than how it should work. It is difficult to interpret observations because people may change their normal behavior or make mistakes when they know they are being observed. Identifying what is to be observed, estimating how long it will take, obtaining permission, and explaining what will be done and why can maximize the effectiveness of observation. The observer should not make value judgments and should document notes and impressions as soon as possible.

Systems documentation describes how the system is intended to work. Throughout the survey, the project team should be alert to differences between intended and actual systems operation as they provide important insights into problems and weaknesses.

systems documentation - A complete description of how the system is supposed to work, including questionnaire copies, interview notes, memos, document copies, and models.

Systems analysis work is documented so it can be used throughout the development project. Documentation consists of questionnaire copies, interview notes, memos, document copies, and models. **Physical models** illustrate *how* a system functions by describing document flow, computer processes performed, the people performing them, and the equipment used. **Logical models** focus on essential activities (*what* is being done) and the flow of information, not on the physical processes of transforming and storing data. Table 22-5 lists analysis and design tools and techniques used to create an AIS and identifies the chapter where each is discussed.

physical models - Descriptions of how systems function by describing document flow, computer processes performed, the people performing them, and the equipment used.

logical models - System descriptions that focus on what essential activities are performed and the flow of information irrespective of how the flow is actually accomplished.

Once data gathering is complete, the team evaluates the AIS's strengths and weaknesses to develop ideas for designing and structuring the new AIS. When appropriate, strengths are retained and weaknesses corrected.

The systems survey culminates with a **systems survey report**. Table 22-3 shows the table of contents for the Shoppers Mart systems survey report. The report is supported by documentation such as memos, interview and observation notes, questionnaire data, file and record layouts and descriptions, input and output descriptions, copies of documents, E-R diagrams, flowcharts, and data flow diagrams.

systems survey report - A report that summarizes all the activities that took place during the systems survey, including all relevant documentation.

FEASIBILITY STUDY

At this point, the thorough feasibility analysis discussed earlier in the chapter is conducted to determine the project's viability. The feasibility analysis is updated regularly as the project proceeds and costs and benefits become clearer.

INFORMATION NEEDS AND SYSTEMS REQUIREMENTS

Once a project is deemed feasible, the company identifies the information needs of users and documents systems requirements. Table 22-6 is an example of systems requirements.

Determining information needs is a challenging process because of the sheer quantity and variety of information that must be specified. In addition, it may be difficult for employees to articulate their information needs, or they may identify them incorrectly. According to *CIO* magazine, 70% of project failures are due to insufficient, inaccurate, or outdated systems requirements. Figure 22-5 is a humorous view of the types of communication problems associated with this process.

When Corning Corporation investigated the ophthalmic pressings it manufactures, it found that 35% of its drafting documents contained errors. Drafting errors are increasingly

TABLE 22-5 Systems Analysis and Design Tools and Techniques

Agile methodologies (Chapter 23)	Forms design checklist (Chapter 24)
Business process diagrams (Chapter 3)	Gantt charts (Chapter 22)
CASE (Chapter 23)	PERT charts (Chapter 22)
Data dictionary (Chapter 4)	Prototyping (Chapter 23)
Data flow diagrams (Chapter 3)	REA data models (Chapter 19)
E-R diagrams (Chapter 19)	Record layouts (Chapter 4)
Flowcharts (Chapter 3)	

TABLE 22-6 Possible Contents of System Requirements

Processes	Business process descriptions, including what is to be done and by whom
Data elements	The name, size, format, source, and significance of required data elements
Data structure	How the data elements will be organized into logical records
Outputs	Description of the purpose, frequency, and distribution of system outputs
Inputs	Description of contents, source, and person responsible for system inputs
Documentation	How the new system and each subsystem will operate
Constraints	Deadlines, schedules, security requirements, staffing limitations, and statutory or regulatory requirements
Controls	Controls to ensure the accuracy and reliability of inputs, outputs, and processing
Reorganizations	Organizational reorganization needed to meet users' information needs, such as increasing staff levels and adding new job functions

more expensive to correct at each subsequent manufacturing stage: $250 before toolmakers cut the tools, $20,000 before production begins, and $100,000 after the tools are sold. Several corrective actions reduced the error rates from 35% to 0.2%. The same cost relationships exist in systems development; error correction costs increase as development proceeds through the SDLC.

System objectives, such as those shown in Table 22-7, are the elements most vital to an AIS's success. It is difficult for a system to satisfy every objective. For example, designing adequate internal controls is a trade-off between the objectives of economy and reliability.

Because organizational constraints make it difficult to develop all AIS components simultaneously, the system is divided into modules that are developed and installed independently. When changes are needed, only the affected module is changed. The modules must be properly integrated into a workable system.

A system's success often depends on the ability to cope with organizational constraints. Common constraints include governmental agency requirements, management policies, lack of qualified staff, user capabilities and attitudes, technology, and limited finances. To maximize system performance, these constraints must be minimized.

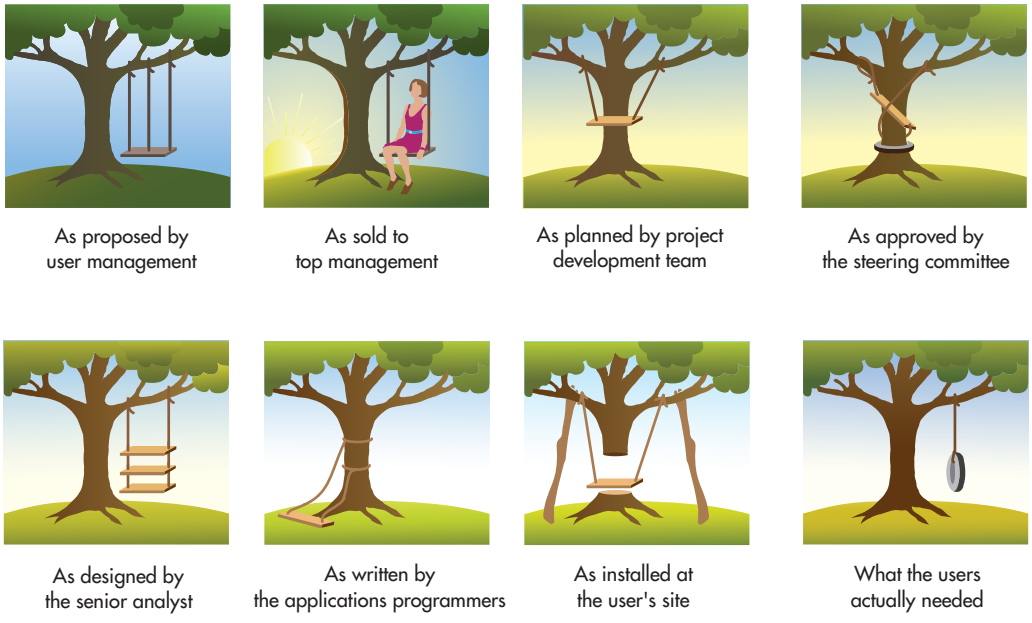

FIGURE 22-5 Communication Problems in Systems Analysis and Design

TABLE 22-7 AIS Objectives

Usefulness	Information output should help management and users make decisions.
Economy	System benefits should exceed the cost.
Reliability	System should process data accurately and completely.
Availability	Users should be able to access the system at their convenience.
Timeliness	Crucial information is produced first, less important items as time permits.
Customer service	Customer service must be courteous and efficient.
Capacity	System capacity must be sufficient to handle periods of peak operation and future growth.
Ease of use	System should be user-friendly.
Flexibility	System should be able to accommodate reasonable requirement changes.
Tractability	System is easily understood and facilitates problem solving and future development.
Auditability	Auditability is built into the system from the beginning.
Security	Only authorized users are granted access to or allowed to change system data.

The following four strategies are used to determine AIS requirements:

1. ***Ask users what they need.*** This is the simplest and fastest strategy, but many people do not understand their needs. They know their job but may be unable to break it down into the individual information elements they use. It is sometimes better to ask what decisions they make and what processes they are involved in and then design systems to address their answers. Users must think beyond current information needs so that new systems do not simply replicate current information in improved formats.
2. ***Analyze external systems.*** If a solution already exists, do not "reinvent the wheel."
3. ***Examine existing systems.*** Determine if existing modules are used as intended, may be augmented by manual tasks, or may be avoided altogether. This approach helps determine whether a system can be modified or must be replaced.
4. ***Create a prototype.*** When it is difficult to identify requirements, a developer can quickly rough out a system for users to critique. Users identify what they like and dislike about the system and request changes. This iterative process of looking at what is developed and improving it continues until users agree on their needs. Prototyping is discussed in Chapter 23.

Detailed AIS requirements that explain exactly what the system is to produce are created and documented. The requirements are supported by sample input and output forms, as well as charts, so users can conceptualize the system. A nontechnical summary of important user requirements and development efforts to date is often prepared for management. The project team meets with the users, explains the requirements, and obtains their approval. When an agreement is reached, user management signs the system requirements documents to indicate approval.

SYSTEMS ANALYSIS REPORT

The concluding step in systems analysis is preparing a **systems analysis report** to summarize and document analysis activities. The Shoppers Mart systems analysis report, shown in Table 22-3, shows the information typically contained in the report.

systems analysis report - Comprehensive report summarizing systems analysis that documents the findings of analysis activities.

A go/no-go decision is made up to three times during systems analysis: first, during the initial investigation, to determine whether to conduct a systems survey; second, at the end of the feasibility study, to determine whether to proceed to the information requirements phase; and third, at the completion of the analysis phase, to decide whether to proceed to conceptual systems design. The remaining phases in the SDLC are discussed in the next two chapters.

Summary and Case Conclusion

After an extensive analysis of Shoppers Mart's current system and core business processes, Ann Christy has proposed some changes. She has asked the corporate office to produce daily sales data for each store to help them adapt quickly to customer needs and to help suppliers avoid stockouts and overstocking. Shoppers Mart will coordinate buying at the corporate office to minimize inventory levels and negotiate lower wholesale prices. Stores will electronically send daily orders to the corporate office. Based on store orders and warehouse inventory, the corporate office will send purchase orders to suppliers. Suppliers will process orders and ship goods to regional warehouses or directly to the stores the day orders are received. Each store will have the flexibility to respond to local sales trends and conditions by placing local orders. Accounts payable will be centralized so payments can be made electronically.

Ann reviews the proposed system with the legal department and the AIS staff. She is told it complies with all legal considerations and is technologically feasible. Top management and the information systems steering committee will decide how to allocate time and resources for the project and will communicate all staff assignments to systems management and personnel.

Ann's team conducts an economic feasibility study (see Table 22-8) and determines that the project makes excellent use of funds. The team estimates that initial outlay costs for the system are $5 million. The team estimates recurring operating costs and expected savings for years 1 through 6, which are expected to rise from year to year. Ann calculates the net annual savings and then calculates the after-tax cash savings for each year.

Payback occurs in the fourth year when the savings net of taxes of $6,266,800 exceed the costs of $5,000,000.

TABLE 22-8 Economic Feasibility of Shoppers Mart's New Information System

	Initial Outlay	Year 1	Year 2	Year 3	YEAR 4	Year 5	Year 6
Initial Outlay Costs							
Hardware	$2,000,000						
Software	400,000						
Training	200,000						
Site preparation	200,000						
Initial systems design	2,000,000						
Conversion	200,000						
Total initial outlays	$5,000,000						
Recurring Costs							
Hardware expansion			$260,000	$300,000	$340,000	$380,000	$400,000
Software			150,000	200,000	225,000	250,000	250,000
Systems maintenance		$60,000	120,000	130,000	140,000	150,000	160,000
Personnel costs		500,000	800,000	900,000	1,000,000	1,100,000	1,300,000
Communication charges		100,000	160,000	180,000	200,000	220,000	250,000
Overhead		300,000	420,000	490,000	560,000	600,000	640,000
Total costs		$960,000	$1,910,000	$2,200,000	$2,465,000	$2,700,000	$3,000,000
Savings							
Clerical cost savings		$600,000	$1,200,000	$1,400,000	$1,600,000	$1,800,000	$2,000,000
Working capital savings		900,000	1,200,000	1,500,000	1,500,000	1,500,000	1,500,000
Profits from sales increases			500,000	900,000	1,200,000	1,500,000	1,800,000
Warehousing efficiencies			400,000	800,000	1,200,000	1,600,000	2,000,000
Total savings		$1,500,000	$3,300,000	$4,600,000	$5,500,000	$6,400,000	$7,300,300
Savings Minus Recurring Costs		$540,000	$1,390,000	$2,400,000	$3,035,000	$3,700,000	$4,300,000
Less income taxes (34% rate)		(183,600)	(472,600)	(816,600)	(1,031,900)	(1,258,000)	(1,462,000)
Cash savings (net of tax)		356,400	917,400	1,584,000	2,003,100	2,442,000	2,838,000
Savings on taxes (due to depreciation deduction)		340,000	544,000	326,400	195,500	195,500	98,600
Net savings	($5,000,000)	$696,400	$1,461,400	$1,910,400	$2,198,600	$2,637,500	$2,936,600

Net Present Value (Interest Rate of 10%):

	($5,000,000)
696,400 x 0.9091 =	633,097
1,461,400 x 0.8265 =	1,207,847
1,910,400 x 0.7513 =	1,435,284
2,198,600 x 0.6830 =	1,501,644
2,637,500 x 0.6209 =	1,637,624
2,936,600 x 0.5645 =	1,657,711
Net present value is	$3,073,207
Internal rate of return is	25.04%

Depreciation on Initial Investment of $5,000,000:

Tax Rate 34%

Year	Rate (%)	Depreciation	Tax Savings
1	20.00	$1,000,000	$340,000
2	32.00	1,600,000	544,000
3	19.20	960,000	326,400
4	11.50	575,000	195,500
5	11.50	575,000	195,500
6	5.80	290,000	98,600

The $5 million system can be depreciated over its six-year expected life. Because the company does not have to pay taxes on the $1 million depreciation in year 1, it ends up saving an additional $340,000. Finally, Ann calculates the net savings for each year.

Ann uses Shoppers Mart's 10% cost of capital rate to calculate the NPV of the investment, which is more than $3 million. The IRR is a lofty 25%, and payback occurs in the fourth year. Ann realizes how advantageous it would be for the company to borrow the money (at a 10% interest rate) to produce a 25% return.

Ann presents the system to management and describes its objectives. Challenges to her estimates are plugged into her spreadsheet model to show their effect. Even the stiffest challenges to Ann's numbers show a positive return. Top management votes to support the new system, requests some changes, and tells Ann to proceed.

Ann has found management's enthusiastic support crucial to the system's success. Several employees with vested interests in the current system are critical of her ideas. Some employees remember the problems Shoppers Mart had when the current system was implemented years ago. Ann concludes that people resisting the new system are afraid of the change's effect on them personally. To counter negative behavioral reactions, Ann takes great pains to explain how the new system would benefit employees individually and how it will affect the company as a whole. With management's approval, she assures employees they will not lose their jobs and that all affected employees will be retrained. She involves the two most vocal opponents in planning activities, and they soon become two of the new system's biggest advocates.

Ann invites the managers of all affected departments to be on a steering committee. A master plan for developing the system is formulated, and the system is broken down into manageable projects. The projects are prioritized, and project teams are formed to begin work on the highest-priority projects. Documentation standards are developed and approved.

KEY TERMS

systems development life cycle (SDLC) 721
systems analysis 721
conceptual design 721
physical design 722
implementation and conversion 722
operations and maintenance 722
information systems steering committee 722
systems analysts 723
computer programmers 723
project development plan 724
master plan 724
program evaluation and review technique (PERT) 725
critical path 725
Gantt chart 725
feasibility study 725
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logical models 733
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systems analysis report 735

AIS in Action

CHAPTER QUIZ

1. Which of the following is not a step to be completed in the Systems Analysis phase of the systems development life cycle?
a. deliver system requirements
b. perform feasibility study
c. develop design specifications
d. determine information needs and system requirements

2. Which of the following is not contained within a project development plan?
a. cost-benefit analysis
b. who will undertake development
c. operational requirements
d. schedule of activities required

3. The purchasing department is designing a new AIS. Who is best able to determine departmental information requirements?
a. steering committee
b. controller
c. top management
d. purchasing department

4. Which of the following is the correct order of the steps in systems analysis?
a. initial investigation, determination of information needs and system requirements, feasibility study, system survey
b. determination of information needs and system requirements, system survey, feasibility study, initial investigation
c. system survey, initial investigation, determination of information needs and system requirements, feasibility study
d. initial investigation, system survey, feasibility study, determination of information needs and system requirements

5. Which of the following is the long-range planning document that specifies what the system will consist of, how it will be developed, who will develop it, how needed resources will be acquired, and its overall vision?
a. steering committee agenda
b. master plan
c. systems development life cycle
d. project development plan

6. Resistance is often a reaction to the methods of instituting change rather than to change itself.
a. true
b. false

7. Which of the following is not contained within a request for systems development?
a. proposed system objectives
b. development schedule
c. anticipated costs and benefits
d. description of current problems

8. Which of the following provides a detailed description of how a system is intended to work?
a. systems survey report
b. systems documentation
c. operational feasibility
d. technical feasibility

9. Determining whether the organization has access to people who can design, implement, and operate the proposed system is referred to as which of the following?
a. technical feasibility
b. operational feasibility
c. legal feasibility
d. scheduling feasibility
e. economic feasibility

10. Which of the following capital budgeting techniques can be used to calculate economic feasibility of a proposed system?

a. payback period
b. net present value
c. internal rate of return
d. all of the above

COMPREHENSIVE PROBLEM

Riverbend Software Support Administrators (RSSA) provides online and telephone help desk services. Because RSSA's labor costs have steadily increased, it is outsourcing its call center. RSSA's executive-level committee, who oversees the information systems (IS) function, selected a project development team to create a system to move the help desk and manage it from corporate headquarters.

Two incidents delayed the help desk conversion date by 15 days. A server was damaged when an unidentified employee put a hot coffee pot on it, and several backup tapes were found floating in a restroom sink.

The five-year contract requires an initial payment of $1,750,000 and yearly payments of $525,000. Each year, the contract will save $750,000 in salary, benefits, and equipment costs. There is a $150,000 one-time charge for breaking the current call center's building lease, but doing so will save $360,000 a year. RSSA's cost of capital is 11%.

REQUIRED

a. What is the executive-level committee commonly called, who typically serves on it, and what is its primary function?
b. Who typically serves on the project development team?
c. What steps would the development team take during system analysis?
d. Why do you think the server and data tapes were damaged?
e. Calculate the following capital budgeting metrics for RSSA's outsourcing plan:
   1. payback period
   2. net present value (NPV)
   3. internal rate of return (IRR)

DISCUSSION QUESTIONS

22.1 The approach to long-range AIS planning described in this chapter is important for large organizations with extensive investments in computer facilities. Should small organizations with far fewer information systems employees attempt to implement planning programs? Why, or why not? Be prepared to defend your position to the class.

22.2 You have been approached by the owner of ShopSmart, a local general dealer, to give advice regarding the implementation of an accounting information system. ShopSmart currently uses a manual system to manage everything: from ordering inventory to handling sales. You are asked to explain the process that will be used to design and implement a new accounting information system at ShopSmart while taking into account that there current system is a completely manual system.

22.3 Why is it important that systems development is properly planned? Refer to the advantages of planning systems development in your discussion.

22.4 For the following, discuss which data-gathering method(s) are most appropriate and why:
a. examining the adequacy of internal controls in the purchase requisition procedure
b. identifying the controller's information needs
c. determining how cash disbursement procedures are actually performed
d. surveying employees about the move to a total quality management program
e. investigating an increase in uncollectible accounts

22.5 One of the main issues to consider during systems development is to determine the feasibility of the proposed project. Discuss the purpose of a feasibility study, and discuss examples of different types of feasibility that need to be considered.

22.6 Give some examples of systems analysis decisions that involve a trade-off between each of the following pairs of objectives:
a. economy and usefulness
b. economy and reliability
c. economy and customer service
d. simplicity and usefulness
e. simplicity and reliability
f. economy and capacity
g. economy and flexibility

22.7 For each of the following items, discuss which of the four data gathering methods would be most appropriate and why.
a. Eliciting 300 employees' opinions on a new incentive program to replace the current bonus program.
b. Identifying how the credit approval process for new customers should be conducted and by whom.

22.8 Discuss the strategies often used to determine requirements for a proposed AIS.

22.9 Ajax Manufacturing installed a new bar-code-based inventory tracking system in its warehouse. To close the books each month on a timely basis, the six people who work in the warehouse must scan each item in a 36-hour period while still performing their normal duties. During certain months, when inventory expands to meet seasonal demands, the scan takes as many as 30 hours to complete. In addition, the scanners do not accurately record some inventory items that require low operating temperatures. A recent audit brought to management's attention that the inventory records are not always accurate. Which aspect(s) of feasibility did Ajax fail to consider prior to installing the inventory tracking system?

PROBLEMS

22.1 Match the terms with their definitions:

____	**1.** systems analysis	a.	Process of deciding how to meet user needs, identifying and evaluating design alternatives, and developing detailed system specifications
____	**2.** conceptual design	b.	Describes a system's contents; how it's developed, by whom, and when; and how needed resources will be acquired
____	**3.** physical design	c.	Description of a system's document flow, computer processes and people performing them, and equipment used
____	**4.** implementation and conversion	d.	Resisting change by destroying, crippling, or weakening system effectiveness such as increased error rates or sabotage
____	**5.** IS steering committee	e.	Bar graph that shows project activities on the left, units of time on the top, and activity time requirements as a horizontal bar

____	**6.** systems analysts	f.	Resisting change by ignoring a new IS and hoping the new system will go away
____	**7.** master plan	g.	Document showing project requirements, a cost–benefit analysis, and how a project will be completed
____	**8.** PERT diagram	h.	High-level management that plans and oversees the IS function, sets policies to govern the AIS, ensures control, and coordinates activities
____	**9.** critical path	i.	Calculation of the number of years required for the net savings of an investment to equal its initial cost
____	**10.** Gantt chart	j.	Calculating the interest rate that makes the present value of total costs equal to the present value of total savings
____	**11.** feasibility study	k.	System description that focuses on activities performed and information flow regardless of how the flow is accomplished
____	**12.** economic feasibility	l.	People who help users determine their information needs, study existing systems, and design new ones
____	**13.** technical feasibility	m.	SDLC step of gathering information needed to purchase, develop, or modify a system
____	**14.** operational feasibility	n.	PERT path requiring the greatest amount of time to complete a project; if any activity is delayed, the whole project is delayed
____	**15.** payback period	o.	Way to coordinate, control, and schedule systems development activities; a diagram shows the relationships among activities
____	**16.** NPV	p.	Determining if system benefits justify the time, money, and resources required to implement it
____	**17.** IRR	q.	Return-on-investment technique that compares estimated benefits and costs to determine if a system is cost beneficial
____	**18.** aggression	r.	Detailed specifications are used to code and test software, design input/output, and create files/databases, and implement controls
____	**19.** avoidance	s.	Process in which procedures are tested and modified, controls are established, documentation is completed, and employees are trained on a new system
____	**20.** initial investigation	t.	Determining if a company needs the people to design, implement, and operate the proposed system and if employees will use it
____	**21.** systems survey	u.	Determining if a proposed system can be developed given the available technology
____	**22.** logical model	v.	Preliminary investigation to determine whether a proposed new system is both needed and feasible

w. Extensive study of the current AIS

x. Resisting change by blaming everything on the new system so it becomes the scapegoat for all problems and errors

y. Investigation to determine if it is practical to develop a new application or system

z. Discounting estimated future cash flows back to the present using a discount rate that reflects the time value of money

22.2 Mary Smith is the bookkeeper for Dave's Distributing Company, a distributor of soft drinks and juices. Because the company is rather small, Mary performs all daily accounting tasks herself. Dave, the owner of the company, supervises the warehouse/delivery and front office staff, but he also spends much of his time jogging and skiing.

For several years, profits were good, and sales grew faster than industry averages. Although the accounting system was working well, bottlers were pressuring Dave to computerize. With a little guidance from a CPA friend and with no mention to Mary, Dave bought a new computer system and some accounting software. Only one day was required to set up the hardware, install the software, and convert the files. The morning the vendor installed the computer system, Mary's job performance changed dramatically. Although the software company provided two full days of training, Mary resisted learning the new system. As a result, Dave decided she should run both the manual and computer systems for a month to verify the new system's accuracy.

Mary continually complained that she lacked the time and expertise to update both systems by herself. She also complained that she did not understand how to use the new computer system. To keep accounts up to date, Dave spent two to three hours a day running the new system himself. Dave found that much of the time spent running the system was devoted to identifying discrepancies between the computer and manual results. When the error was located, it was usually in the manual system. This significantly increased Dave's confidence in the new system.

At the end of the month, Dave was ready to scrap the manual system, but Mary said she was not ready. Dave went back to skiing and jogging, and Mary went on with the manual system. When the computer system fell behind, Dave again spent time catching it up. He also worked with Mary to try to help her understand how to operate the computer system.

Months later, Dave was very frustrated because he was still keeping the computer system up to date and training Mary. He commented, "I'm sure Mary *knows* how to use the system, but she doesn't seem to *want* to. I can do all the accounting work on the computer in two or three hours a day, but she can't even do it in her normal eight-hour workday. What should I do?"

REQUIRED

a. What do you believe is the real cause of Mary's resistance to computers?
b. What events may have contributed to the new system's failure?
c. In retrospect, how should Dave have handled the accounting system computerization?
d. At what point in the decision-making process should Mary have been informed? Should she have had some say in whether the computer was purchased? If so, what should have been the nature of her input? If Mary had not agreed with Dave's decision to acquire the computer, what should Dave have done?
e. A hard decision must be made about Mary. Significant efforts have been made to train her, but they have been unsuccessful. What would you recommend at this point? Should she be fired? Threatened with the loss of her job? Moved somewhere else in the business? Given additional training?

22.3 A large pharmaceutical company had decided in the early 1990s that they needed an upgraded information system to increase their efficiency in, amongst others, their distribution facility, handling inventory and customer orders, shipping, and billing. The company had some of their employees look at the different products that are available on the market and, after some product reviews and evaluation, the company decided on SAP R/3. Subsequently, the company purchased the SAP R/3 enterprise resource planning system and decided to also acquire a warehouse automation system to manage their inventory at their warehouses. Management decided on a consultancy firm to handle the integration and implementation of SAP R/3 and the warehouse automation systems. Management believed that the combination of these two systems would enable them to be handle more customer orders and ultimately be more profitable.

Implementation of these systems took place in the two years following the original purchase of the SAP R/3 system.

The warehouse employees were unsettled by the new implementation as the integration of SAP R/3 and the warehouse automation system threatened the jobs of many of the warehouse employees. In the period after the implementation was started, large volumes of inventory were damaged, orders were not filled, and many mistakes were made in the new system. Seemingly, the new system could not handle the volume of transactions.

Shortly after the project to implement and integrate SAP R/3 and the warehouse automation began, the company signed a huge deal with a health care company. This deal required additional transaction volumes and the new system could not manage to process the required transactions. It was determined that the new system could only manage 10,000 customer orders every night, while the previous system managed 420,000 orders per night (orders were processed in batch mode at night). The company needed high transaction volumes to stay profitable, and the implementation and integration of the new systems, coupled with the large, newly acquired contract, was meant to provide the company with a competitive edge.

The pharmaceutical company relied on consultancy employees to implement and integrate the new systems and it was found that the 50 consultants that were available to handle the implementation and integration were not sufficiently skilled. Since the consultants were not able to manage the implementation and integration with their current skill sets, the turnover of consultants was high.

The original budget included about $5 million for acquiring new hardware, $4 million for the new software, $18 million for a new computerized warehouse, and several (undisclosed) millions for consulting fees.

In the end, the planned project was a complete disaster with a final cost of approximately $100 million, leading to the demise of the company.

In this case, there were specific issue identified with the planning and the implementation of the proposed system.

REQUIRED

a. Explain the impact that a lack of planning had on the failed implementation. What could have been done to prevent the failure from occurring in terms of planning?
b. Explain the impact that implementation issues had on the failed implementation. What could have been done to prevent the failure from happening in terms of implementation?

22.4 Research has shown that many software development projects are late, others run over budget, while still others are unsuccessful. There are several reasons for unsuccessful information system projects, and one of the reasons is project management failure. What is the task of a project manager in an information systems development team? What are the typical skills required by a project manager? Discus the major roles or responsibilities a project manager needs to master to ensure successful project management.

22.5 Rossco is considering the purchase of a new computer with the following estimated costs: initial systems design, $54,000; hardware, $74,000; software, $35,000, one-time initial training, $11,000; system installation, $20,000; and file conversion, $12,000. A

net reduction of three employees is expected, with average yearly salaries of $40,000. The system will decrease average yearly inventory by $150,000. Annual operating costs will be $30,000 per year.

The expected life of the machine is four years, with an estimated salvage value of zero. The effective tax rate is 40%. All computer purchase costs will be depreciated using the straight-line method over its four-year life. Rossco can invest money made available from the reduction in inventory at its cost of capital of 11%. All cash flows, except for the initial investment and start-up costs, are at the end of the year. Assume 365 days in a year.

REQUIRED

Use a spreadsheet to perform a feasibility analysis to determine whether Rossco should purchase the computer. Compute the following as part of the analysis: initial investment, after-tax cash flows for years 1 through 4, payback period, net present value, and internal rate of return.

22.6 Joanne Grey, a senior consultant, and David Young, a junior consultant, are conducting a systems analysis for a client to determine the feasibility of integrating and automating clerical functions. Joanne had previously worked for the client, but David was a recent hire.

The first morning on the job, Joanne directed David to interview a departmental supervisor and learn as much as possible about department operations. David introduced himself and said, "Your company has hired us to study how your department works so we can make recommendations on how to improve its efficiency and lower its cost. I would like to interview you to determine what goes on in your department."

David questioned the supervisor for 30 minutes but found him to be uncooperative. David gave Joanne an oral report on how the interview went and what he learned about the department.

REQUIRED

Describe several flaws in David's approach to obtaining information. How should this task have been performed?

22.7 The following lists specific project activities and their scheduled starting and completion dates. For simplicity sake, work from the assumption that all activities start on a Monday and end on a Friday.

Activity	Start Date	End Date
A	3 June	14 Jun
B	10 June	28 Jun
C	24 June	5 Jul
D	1 Jul	5 Jul
E	1 Jul	19 Jul
F	15 Jul	2 Aug
G	22 Jul	26 Jul
H	8 Jul	2 Aug

a. Use a format similar to that of Figure 20-3 and prepare a Gantt chart for this project.
b. Assume you review the project progress on 12 July. Activity progress are as follows:
   - Activities A, B, and D have been completed
   - Activity C is 50% completed
   - Activity E is 66% completed
   - Activity F is 30% completed
   - Activity G has not started yet
   - Activity H is 50% completed

   Record this information on your Gantt chart and then determine if the project is behind schedule, on schedule, or ahead of schedule. Explain.

c. What are the advantages and the disadvantages of using a Gantt chart as a project planning tool?

22.8 Businesses often modify or replace their financial information system to keep pace with their growth and take advantage of improved IT. This requires a substantial time and resource commitment. When an organization changes its AIS, a systems analysis takes place.

REQUIRED

a. Explain the purpose and reasons for surveying an organization's existing system.
b. Explain the activities commonly performed during systems analysis.
c. Systems analysis is often performed by a project team composed of a systems analyst, a management accountant, and other knowledgeable and helpful people. What is the management accountant's role in systems analysis? *(CMA Examination, adapted)*

22.9 Managers at some companies face an ongoing systems development problem: IS departments develop systems that businesses cannot or will not use. At the heart of the problem is a gap that separates the world of business and the world of IS that many departments are unable or ready to cross.

One reason for the crisis is that many companies are looking for ways to improve existing, out-of-date systems or to build new ones. Another is high user expectations that IS departments are not meeting. Users seek more powerful applications than are available on many older systems.

The results can be devastating. An East Coast chemical company spent more than $1 million on a budgeting and control system that was never used. The systems department's expertise was technical excellence, not budgets. As a result, the new system completely missed the mark when it came to meeting business needs.

In another instance, a Midwestern bank used an expensive computer-aided software engineering (CASE) tool to develop a system that users ignored because there had been no design planning. A senior analyst for the bank said, "They built the system right; but unfortunately, they didn't build the right system."

REQUIRED

a. What causes this gap?
b. What would you suggest to solve this problem?
c. Discuss the roles a systems designer, business manager, and end user can take to narrow this gap.
d. Who plays the most vital role in the effective development of the system?

22.10 Focus 22-1 described the IRS's attempts to replace its aging information systems. Many other governmental agencies have similar problems. News reports indicate that the U.S. government is spending billions to keep antiquated computer systems running. Other reports describe how some governmental agencies still use floppy disks to store data. Conduct a search (using written materials, the Internet, electronic databases, etc.) for information on how governmental agencies need to replace its aging legacy systems. Per your professor's instructions, prepare an oral or written summary reporting your findings.

22.11 Select the correct answer for each of the following multiple-choice questions.

1. In which SDLC step does the company translate broad, user-oriented systems requirements into the detailed specifications used to create a fully developed system?
   a. physical design
   b. systems analysis
   c. conceptual design
   d. implementation and conversion
   e. operations and maintenance

2. Who in the organization is responsible for planning individual system development projects and monitoring the project to ensure timely and cost-effective completion?
   a. management
   b. project development team
   c. users
   d. information systems steering committee
   e. systems analysts

3. There are several different types of feasibility analysis. Which type of analysis seeks to answer the question: "Does the system comply with all applicable federal and state laws, administrative agency regulations, and contractual obligations?"
   a. legal feasibility
   b. economic feasibility
   c. technical feasibility
   d. scheduling feasibility
   e. operational feasibility

4. When a new or improved system is needed, which document describes the problem, explains the need for a change, lists the proposed system's objectives, and explains its anticipated benefits and costs?
   a. request for initial investigation
   b. request for systems analysis
   c. request for systems development
   d. request for feasibility analysis

5. A systems survey is an extensive study of the current AIS that has a number of objectives. Which of the following is not one of those objectives?
   a. Gain an understanding of company operations, policies, and procedures
   b. Make preliminary assessments of current and future processing needs
   c. Develop working relationships with users, and build support for the AIS
   d. Develop a blueprint for detailed systems design that can be given to management
   e. Collect data that identify user needs and conduct a feasibility analysis

6. At the end of the systems analysis process, systems developers need to do all of the following except _____.
   a. create and document detailed system requirements that explain exactly what the system will produce.
   b. explain the requirements to users, obtain their approval, and have user management sign system requirements documents to indicate their approval.
   c. prepare a detailed and technical document of all user requirements for top management.
   d. prepare a systems analysis report to summarize and document all analysis activities.

7. In which SDLC step do all the elements and activities of the system come together to form a completed operational system?
   a. systems analysis
   b. conceptual design
   c. physical design
   d. operations and maintenance
   e. implementation and conversion

8. Who in the organization is responsible for planning and overseeing the information systems function?
   a. management
   b. users
   c. project development team
   d. systems analysts
   e. information systems steering committee

9. There are several different types of feasibility analysis. The analysis that seeks to answer the question "Can the system be developed and implemented using existing technology?" is called _____ feasibility.
   a. economic
   b. legal
   c. scheduling
   d. technical
   e. operational

10. With respect to an initial investigation, which of the following statements is false?
   a. A project's scope is a description of what a development project should and should not accomplish.
   b. A new AIS is often the answer to organizational problems because it provides needed structures and processes.
   c. A new AIS is useful when the identified problem is a result of the lack of information or inefficient data processing.
   d. The initial investigation should determine a project's viability and recommend it be initiated as proposed, modified, or abandoned.
   e. Approved projects should be assigned a priority and added to the organization's master plan.

11. Which of the following statements is false?
   a. When data gathering is complete, the current system's strengths and weaknesses are evaluated to generate ideas for how to design and structure the new system.
   b. Determining information needs is a relatively easy task because most employees can adequately explain their information needs.
   c. A feasibility analysis is updated regularly as a project proceeds and costs and benefits become clearer.
   d. When a project is deemed feasible, user needs are identified and system requirements are documented.

12. Which approach to gathering data about an organization's existing information system can help verify how a system operates?
   a. interviews
   b. questionnaires
   c. systems documentation
   d. observation

13. Which of the following strategies for determining system requirements is least likely to be successful?
   a. Ask management what information their employees need.
   b. Examine existing systems to find what is working well in the current system.
   c. Analyze external systems so you do not have to "reinvent the wheel."
   d. Create a prototype so users can identify what they like and dislike about the system.

22.13 A PERT chart is a tool that is useful in project planning.
   a. Why would one use a PERT chart as opposed to a Gantt chart?
   b. What are the typical steps you would need to follow to complete a PERT chart?
   c. What are the main advantages project managers can realise when using a PERT chart?
   d. Draw a PERT chart for the following activities:

Activity	Description	Start Date	Duration (days)	Dependency
1	Develop plan	5 June	1	
2	Assign responsibilities	6 June	3	1 must be completed for 2 to start
3	Purchase hardware	6 June	20	1 must be completed for 3 to start
4	Implement system	9 June	60	2 must be completed for 4 to start
5	Install hardware	26 June	10	3 must be completed for 5 to start
6	Develop test cases	8 Aug	20	4 must be completed for 6 to start
7	Compile user guide	6 Jul	30	5 must be completed for 7 to start
8	Import data	6 Jul	20	5 must be completed for 8 to start
9	Perform system testing	28 Aug	10	6 must be completed for 9 to start
10	Train users	20 Aug	20	7 and 8 must be completed for 10 to start
11	Perform user acceptance test	12 Sep	20	9 and 10 must be completed for 11 to start

22.14 A company hired a consultancy firm to determine the feasibility of integrating their automated warehouse function into their enterprise resource planning system. The consultancy firm sent two junior consultants, Mpumelelo Ngwabe and Joyce Stanger, on a site visit to gather data from the users. The instruction the two junior consultants received was to interview and observe the actual users of the system and to report back what they have found.

On their way over to the client, Mpumelelo and Joyce decided that Mpumelelo will interview available warehouse staff in their offices while Joyce will observe what happens on the warehouse floor. Mpumelelo managed to interview two staff members separately. The two interview experiences were like chalk and cheese: the first interview lasted more than two hours and Mpumelelo found the employee friendly and willing to talk about almost everything, including common interests that they shared. The other interview was a painful experience with a much older employee that lasted no more than ten minutes, with the employee being uncooperative. Joyce managed to observe some of the workers in the warehouse while they were performing their normal duties. However, after about 20 minutes of observation, one of the employees noticed Joyce and asked if she was lost or needed some help. Joyce briefly explained that she is here as part of a team to investigate the integration of the automated warehouse function into the enterprise resource planning system. When the employee returned to the warehouse floor, Joyce noticed that there was quite a lot of conversations taking place and, after a while, the behavior of the employees on the warehouse floor was slightly different from what she had initially observed.

On their way back to the office, Mpumelelo and Joyce strategized as to how they would convey their findings to their manager when they meet with him in 45 minutes.

REQUIRED

Describe any areas of concern you have that relates to the way in which Mpumelelo and Joyce gathered information and explain what should have been done differently.

CASE 22-1 Audio Visual Corporation

Audio Visual Corporation (AVC) manufactures and sells visual display equipment. Headquartered in Boston, it has seven sales offices with nearby warehouses that carry its inventory of new equipment and replacement parts. AVC has a departmentalized manufacturing plant with assembly, maintenance, engineering, scheduling, and cost accounting departments as well as several component parts departments.

When management decided to upgrade its AIS, they installed a mainframe at headquarters and local area networks at each sales office. The IS manager and four systems analysts were hired shortly before they integrated the new computer and the existing AIS. The other IS employees have been with the company for years.

During its early years, AVC had a centralized decision-making organization. Top management formulated all plans and directed all operations. As the company expanded, decision making was decentralized, although data processing was highly centralized. Departments coordinated their plans with the corporate office but had the freedom to develop their own sales programs. However, information problems developed, and the IS department was asked to improve the company's information processing system once the new equipment was installed.

Before acquiring the new computer, the systems analysts studied the existing AIS, identified its weaknesses, and designed applications to solve them. In the 18 months since the new equipment was acquired, the following applications were redesigned or developed: payroll, production scheduling, financial statement preparation, customer billing, raw materials usage, and finished goods inventory. The departments affected by the changes were rarely consulted until the system was operational.

Recently the president stated, "The systems people are doing a good job, and I have complete confidence in their work. I talk to them frequently, and they have encountered no difficulties in doing their work. We paid a lot of money for the new equipment, and the systems people certainly cost enough, but the new equipment and new IS staff should solve all our problems."

Two additional conversations regarding the new AIS took place.

BILL TAYLOR, IS MANAGER, AND JERRY ADAMS, PLANT MANAGER

JERRY: Bill, you're trying to run my plant for me. I'm the manager, and you keep interfering. I wish you would mind your own business.

BILL: You've got a job to do, and so do I. As we analyzed the information needed for production scheduling and by top management, we saw where we could improve the workflow. Now that the system is operational, you can't reroute work and change procedures because that would destroy the value of the information we're processing. And while I'm on that subject, we can't trust the information we're getting from production. The documents we receive from production contain a lot of errors.

JERRY: I'm responsible for the efficient operation of production. I'm the best judge of production efficiency. The system you installed reduced my workforce and increased the workload of the remaining employees, but it hasn't improved anything. In fact, it might explain the high error rate in the documents.

BILL: This new computer cost a lot of money, and I'm trying to make sure the company gets its money's worth.

JERRY ADAMS, PLANT MANAGER AND TERRY WILLIAMS, HUMAN RESOURCES MANAGER

JERRY: My best production assistant, the one I'm grooming to be a supervisor, told me he was thinking of quitting. When I asked why, he said he didn't enjoy the work anymore. He's not the only one who is unhappy. The supervisors and department heads no longer have a voice in establishing production schedules. This new computer system took away the contribution we made to company planning and direction. We're going back to when top management made all the decisions. I have more production problems now than I ever had. It boils down to my management team's lack of interest. I know the problem is in my area, but I thought you could help me.

TERRY: I have no recommendations, but I've had similar complaints from purchasing and shipping. We should explore your concerns during tomorrow's plant management meeting.

ANSWER THE FOLLOWING QUESTIONS:

1. Identify the problems the new computer system created, and discuss what caused them.
2. How could AVC have avoided the problems? How can they prevent them in the future?

(*CMA Examination, adapted*)

AIS in Action Solutions

QUIZ KEY

1. Which of the following is not a step to be completed in the Systems Analysis phase of the systems development life cycle?
   a. deliver system requirements [Incorrect. Delivering system requirements is one of the final steps in the systems analysis phase.]
   b. perform feasibility study [Incorrect. Determining the feasibility of the project is part of the systems analysis phase.]
► c. develop design specifications [Correct. Is part of the conceptual design phase which follows the systems analysis phase.]
   d. determine information needs and system requirements [Incorrect. This is part of system analysis phase.]

2. Which of the following is not contained within a project development plan?
   a. cost-benefit analysis [Incorrect. This is part of the project development plan.]
► **b.** who will undertake development [Correct. The master plan identifies who will be undertaking development.]
   c. operational requirements [Incorrect. This is part of the project development plan.]
   d. schedule of activities required [Incorrect. This is part of the project development plan.]

3. The purchasing department is designing a new AIS. Who is best able to determine departmental information requirements?
   a. steering committee [Incorrect. The steering committee is a high-level executive committee that oversees the function of the information system; they probably do not understand the purchasing department's information requirements.]
   b. controller [Incorrect. The controller is the manager of the accounting department and probably does not understand all of the purchasing department's information requirements.]
   c. top management [Incorrect. Top management in such cases should provide direction and resources, not analysis of the purchasing department's information requirements.]
► **d.** purchasing department [Correct. The people who will actually be using the new system are in the best position to determine the system's information requirements.]

4. Which of the following is the correct order of the steps in systems analysis?
   a. initial investigation, determination of information needs and system requirements, feasibility study, system survey [Incorrect. See Figure 22-4.]
   b. determination of information needs and system requirements, system survey, feasibility study, initial investigation [Incorrect. See Figure 22-4.]
   c. system survey, initial investigation, determination of information needs and system requirements, feasibility study [Incorrect. See Figure 22-4.]
► **d.** initial investigation, system survey, feasibility study, determination of information needs and system requirements [Correct. See Figure 22-4.]

5. Which of the following is the long-range planning document that specifies what the system will consist of, how it will be developed, who will develop it, how needed resources will be acquired, and its overall vision?
   a. steering committee agenda [Incorrect. The steering committee's agenda would involve discussing all aspects of the information system, not just system development.]
► **b.** master plan [Correct.]
   c. systems development life cycle [Incorrect. The systems development life cycle is not a long-range planning document but a conceptual framework that applies to systems development in general.]
   d. project development plan [Incorrect. The project development plan is used for individual projects. It includes such items as cost–benefit analyses, developmental and operational requirements, and a schedule of activities for developing and operating the new system.]

6. Resistance is often a reaction to the methods of instituting change rather than to change itself.

► **a**. true [Correct. Although change is generally difficult, the way change is instituted can either facilitate the change or hinder the change.]

b. false [Incorrect.]

7. Which of the following is not contained within a request for systems development?

a. proposed system objectives [Incorrect. The request for systems development needs to identify the objectives of the proposed system and what it aims to achieve.]

► b. development schedule [Correct. Is not part of the request for systems development, as this is only the request for systems development.]

c. anticipated costs and benefits [Incorrect. The request for systems development needs to outline what possible costs could be incurred and what benefits could be realized.]

d. description of current problems [Incorrect. The request for systems development needs to describe the current problems that are encountered.]

8. Which of the following provides a detailed description of how a system is intended to work?

a. systems survey report [Incorrect. This report summarizes all activities from the system survey which aims to report on an extensive study of the current AIS.]

► b. systems documentation [Correct. This document identifies how the system should work and it includes all data gathering notes as well as all models.]

c. operational feasibility [Incorrect. Operational feasibility determines if the company has the people with appropriate skills to design, implement, and operate the proposed system and indicates if the employees will use the new system.]

d. technical feasibility [Incorrect. Technical feasibility determines if a proposed system can be developed given the available technology]

9. Determining whether the organization has access to people who can design, implement, and operate the proposed system is referred to as which of the following?

a. technical feasibility [Incorrect. Technical feasibility refers to whether the system can be developed and implemented with existing technology.]

► **b**. operational feasibility [Correct. Operational feasibility refers to whether the organization and its people can actually design, implement, and operate the system.]

c. legal feasibility [Incorrect. Legal feasibility refers to whether the system complies with all applicable laws and regulations.]

d. scheduling feasibility [Incorrect. Scheduling feasibility refers to whether the system can be analyzed, planned, designed, and implemented in the time allocated.]

e. economic feasibility [Incorrect. Economic feasibility refers to whether the system's benefits outweigh its costs.]

10. Which of the following capital budgeting techniques can be used to calculate economic feasibility of a proposed system?

a. payback period [Incorrect. Although this method can be used, all the others can also be used.]

b. net present value [Incorrect. Although this method can be used, all the others can also be used.]

c. internal rate of return [Incorrect. Although this method can be used, all the others can also be used.]

► d. all of the above [Correct. All three techniques can be used to determine economic feasibility.]

COMPREHENSIVE PROBLEM SOLUTION

a. *What is the executive-level committee commonly called, who typically serves on it, and what is its primary function?*

An information systems steering committee, which plans and oversees the IS function, consists of high-level management people, such as the controller and systems and user-department management. The committee sets IS policies; ensures top-management participation, guidance, and control; and facilitates the coordination and integration of systems activities.

b. *Who typically serves on the project development team?*

The project development team includes systems analysts, systems specialists, managers, accountants, systems auditors, and users.

c. *What steps would the development team take during system analysis?*

RSSA's development team will do an initial assessment of management's plans for moving the help desk. They will survey the existing system to determine what it does, what the company should continue to use, and what should be changed for the new system. They will complete a feasibility analysis to determine the technical, operational, legal, scheduling, and economic feasibility of the new system. Then the team will determine the system's information needs and requirements. Lastly, the team will prepare a systems analysis report.

d. *Why do you think the server and data tapes were damaged?*

Change is usually difficult for people and organizations. When operations are outsourced, employees can lose their jobs. Apparently, some employees exhibited aggressive behavior toward the new system.

e. *Calculate the following capital budgeting metrics for RSSA's outsourcing plan:*

1. payback period
2. net present value (NPV)
3. internal rate of return (IRR)

Table 22-9 summarizes the cash spent or saved each year of RSSA's proposed project. The initial contract payment and the lease cancellation penalty occur at the beginning of the project, referred to as year 0. For simplicity's sake, we assume cash flows

TABLE 22-9 Cash Flows for RSSA

Year	0	1	2	3	4	5
Cash Outflows						
Initial contract	−$1,750,000					
Lease cancellation penalty	−$150,000					
Center operations cost		−$525,000	−$525,000	−$525,000	−$525,000	−$525,000
Total cash outflow	−$1,900,000	−$525,000	−$525,000	−$525,000	−$525,000	−$525,000
Cash inflows						
Personnel savings		$750,000	$750,000	$750,000	$750,000	$750,000
Lease cancellation savings		$360,000	$360,000	$360,000	$360,000	$360,000
Total cash inflows	$0	$1,110,000	$1,110,000	$1,110,000	$1,110,000	$1,110,000
Net Cash Flows	−$1,900,000	$585,000	$585,000	$585,000	$585,000	$585,000

take place at the end of the year. For years 1 through 5, the $525,000 expenditure for operations, the $750,000 personnel savings, and the $360,000 lease cancellation savings are entered. The last line of Table 22-9 shows the net cash flows for each period, which are total cash inflows less total cash outflows.

1 PAYBACK

The payback period is when cash inflows equal cash outflows. Table 22-10, which shows cumulative net cash flow totals, indicates that breakeven occurs during year 4. To

TABLE 22-10 Payback for RSSA's Proposed Project

Year	0	1	2	3	4	5
Net cash flows	−$1,900,000	$585,000	$585,000	$585,000	$585,000	$585,000
Cumulative cash flows	−$1,900,000	−$1,315,000	−$730,000	−$145,000	$440,000	$1,025,000
Payback	3.25 years or 3 years, 3 months					

determine how far into year 4, divide year-3 negative cumulative cash flows of $145,000 by year-4 net cash flows of $585,000. It took 25% of the year (145,000/585,000), or 3.25 years, to get to payback.

2 NET PRESENT VALUE

Payback period does not take into consideration the time value of money (a dollar received today is worth more than the same dollar received a year from now). The net present value (NPV) techniques take the time value of money into consideration by using the company's cost of capital, called its discount rate. This rate is the company's average cost of borrowing capital.

Net present value is calculated by multiplying each year's net cash flow by a discount factor calculated using the formula $1/(1+r)n$, where r = the company's discount rate and n = the number of time periods between time 0 and the designated cash flow. For example, if the cash flow occurred at the end of year 4, n would equal 4. The discount factor is calculated for each time period and multiplied by the net cash flow for that period. When all net cash flows have been discounted to their present value, they are totaled to determine the project's NPV.

As a practical matter, most people do not use the formula to make the calculations, but rather use a business calculator or the NPV function in Microsoft Excel.

Projects with a positive NPV earn an estimated return in excess of the company's discount rate and are financially feasible. Projects with a negative NPV are usually rejected. As shown in Table 22-11, RSSA's NPV is $262,103 and the project would likely be acceptable to management.

3 INTERNAL RATE OF RETURN

The NPV calculation does not calculate an estimated rate of return. This limitation is resolved by calculating an internal rate of return (IRR), which is the discount rate that produces an NPV of zero. Calculating an IRR is a trial-and-error process of changing the discount rate until NPV equals zero. Because this is so tedious, IRR is usually calculated using a business calculator or the IRR function in a spreadsheet program. The internal rate of return for this project is 16.35% (rounded).

TABLE 22-11 The Net Present Value of RSSA's Proposed Project

Net cash flows	−$1,900,000	$585,000	$585,000	$585,000	$585,000	$585,000
Present value factors	1	0.9009	0.8116	0.7312	0.6587	0.5935
Present value amounts	−$1,900,000	$527,027	$474,786	$427,752	$385,340	$347,198
Net present value	$262,103					
IRR	16.35%					