

The Systems Development Process

- Chapter 20** Introduction to Systems Development and Systems Analysis
- Chapter 21** AIS Development Strategies
- Chapter 22** Systems Design, Implementation, and Operation

Introduction to Systems Development and Systems Analysis

Learning Objectives

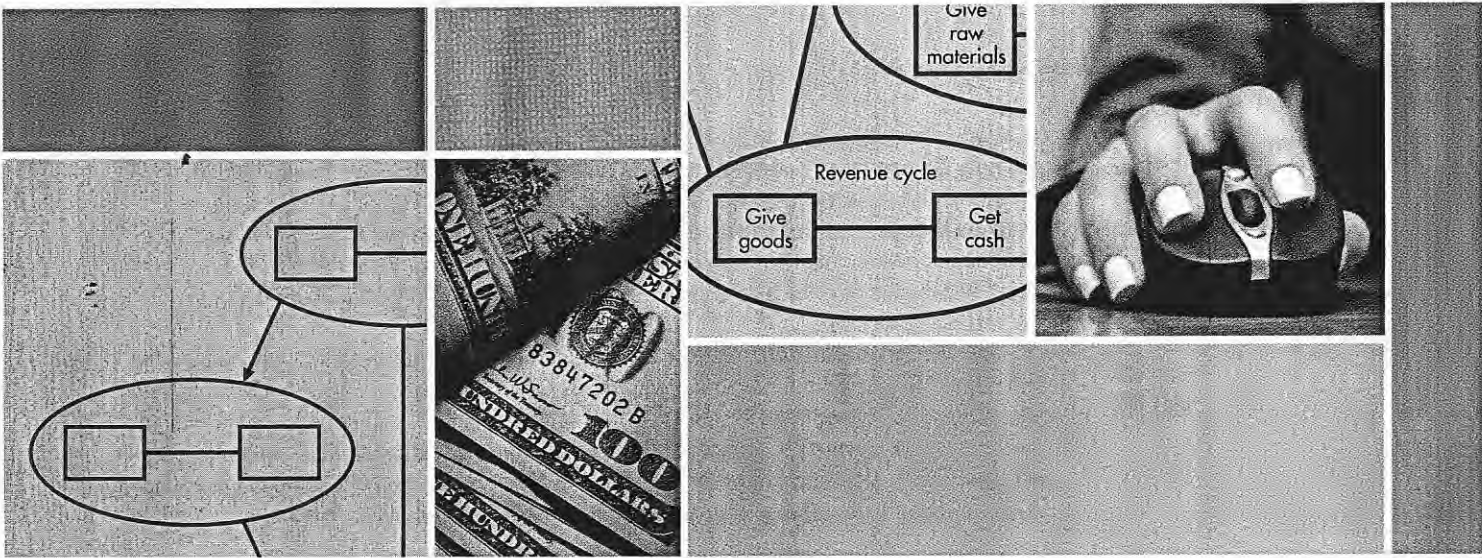
After studying this chapter, you should be able to:

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

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 over \$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 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 is trying to integrate over 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 20-1 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 cause runaways that consume time and money and produce 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 over \$36 million and caused inventory problems that, combined with a faltering economy, resulted in bankruptcy.



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 over \$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."

- 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.

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 20-1 and briefly explained here.

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

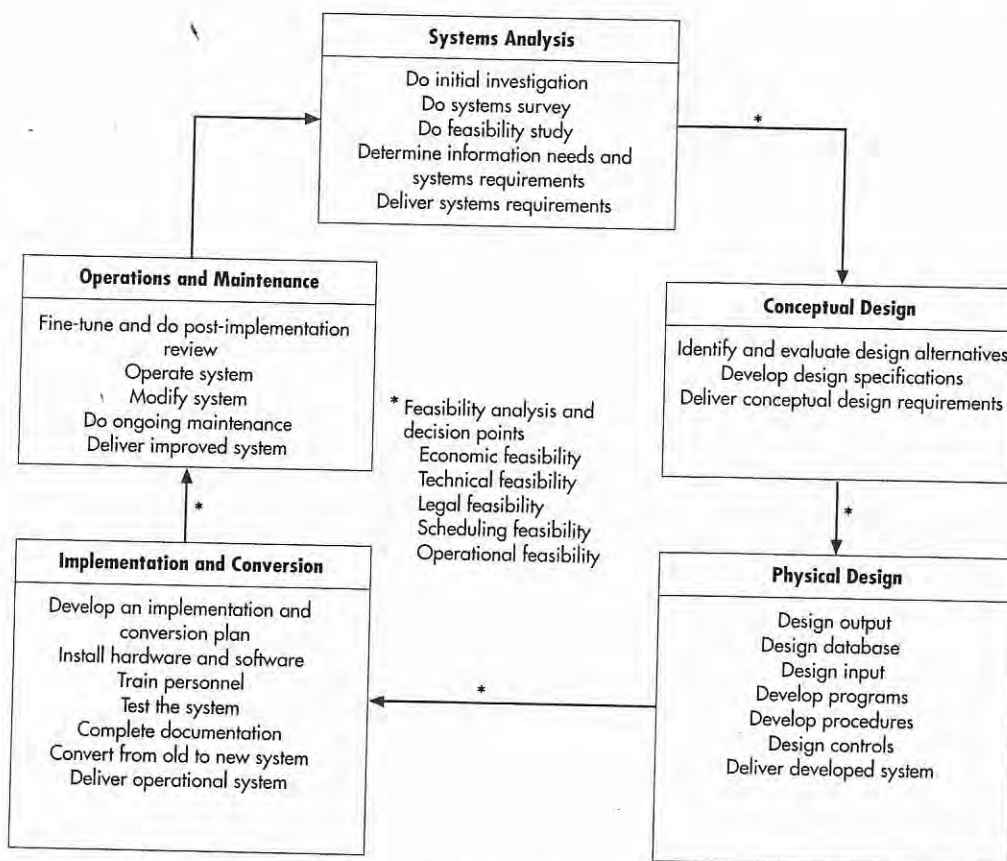


FIGURE 20-1
The Systems Development Life Cycle

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

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 that are used to select or develop a new system. A systems analysis report is prepared and submitted to the information systems steering committee.

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.

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 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 post-implementation 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 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 21. The last four SDLC phases are explained in chapter 22.

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 determine information requirements, assist analysts with cost and benefit estimates, assign staff to development projects, and allocate funds for development and operation.

ACCOUNTANTS AND OTHER 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 and audit issues are discussed in depth in chapters 5 through 11.

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* study existing systems, 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.

Computer programmers write programs using the specifications developed by the analysts. They also 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 20-1).

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, a two-car garage and 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 20-2. This is costly and results in delays, frustration, and low morale.

Two systems development plans are needed:

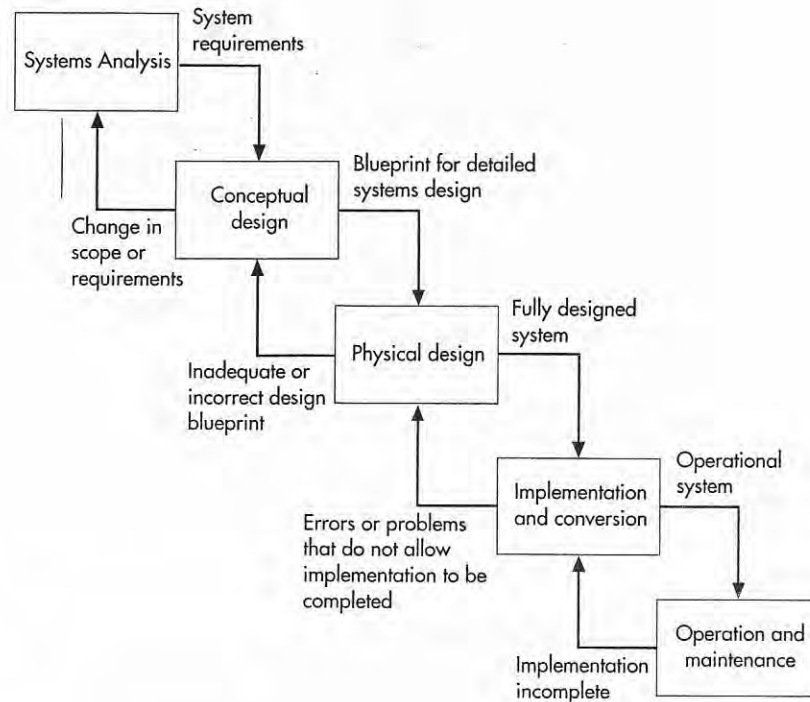
1. **Project development plan.** A *project development plan*, prepared by the project team, contains a cost/benefit analysis, developmental and operational requirements (people, hardware, software, and financial), and a schedule of the activities required to develop and operate the new application.
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 20-1 shows the master plan components at Shoppers Mart.

As explained in Focus 20-2, inadequate planning was one reason why Electronic Data Systems (EDS) lost a significant amount of money in its contract with the U.S. military.

Planning Techniques

PERT and the Gantt charts are techniques for scheduling and monitoring systems development activities. The *program evaluation and review technique (PERT)* requires that all activities and

FIGURE 20-2
Reasons for Returning to a Prior SDLC Phase



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.

A *Gantt chart* (Figure 20-3) 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

TABLE 20-1 Components of the Master Plan at Shoppers Mart

Organizational goals and objectives	Status of systems being developed
Company mission statement and goals	Proposed systems priorities
Information systems strategic plan and goals	Approved systems development
Organizational constraints	Proposals under consideration
Organizational approach to AIS	Development timetables and schedules
Organizational and AIS priorities	Forecast of future developments
Inventory and assessments	Forecasts of information needs
Current systems	Technological forecasts
Approved systems	Environmental/regulatory forecasts
Current hardware	Audit and control requirements
Current software	External user needs
Current AIS staff	
Assessment of strengths and weaknesses	

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 100 institutional accounts with \$4 billion in assets. Focus 20-3 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:

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 20-8 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



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 that is 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.

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 that are 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 20-2. Between 65% and 75% of yearly systems-related expenditures are for maintaining current systems.

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 20-8.

TABLE 20-2 Initial Outlay and Operating Costs

Hardware	Maintenance/backup
Central processing unit	Hardware/software maintenance
Peripherals	Backup and recovery operations
Communications hardware	Power supply protection
Special input/output devices	Documentation
Replacement, upgrade, expansion costs	Systems documentation
Software	Training program documentation
Application, system, general-purpose, utility, and communications software	Operating standards and procedures
Updated versions of software	Site preparation
Application software design, programming, modification, testing, and documentation	Air-conditioning, humidity, dust controls
Staff	Physical security (access)
Supervisors	Fire and water protection
Analysts and programmers	Cabling, wiring, and outlets
Computer operators	Furnishings and fixtures
Input (data conversion) personnel	Installation
Hiring, training, and relocating staff	Freight and delivery charges
Consultants	Setup and connection fees
Supplies and overhead	Conversion
Preprinted forms	Systems testing
Data storage devices	File and data conversions
Supplies (paper, toner)	Parallel operations
Utilities and power	Financial
	Finance charges
	Legal fees
	Insurance

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 over 400 years ago:¹

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.

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.
- **Manner in which 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 are 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 20-4 explains the resistance the U.S. Department of Defense experienced.

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

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


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20-4

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 over \$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 its 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 over 20 years, at a cost of over \$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.

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 *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.

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.

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, handled in a nonconfrontational manner, or sidestepped.
- **Provide training.** Effective use and support is 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

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 20-4 and discussed in this section.

Initial Investigation

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.

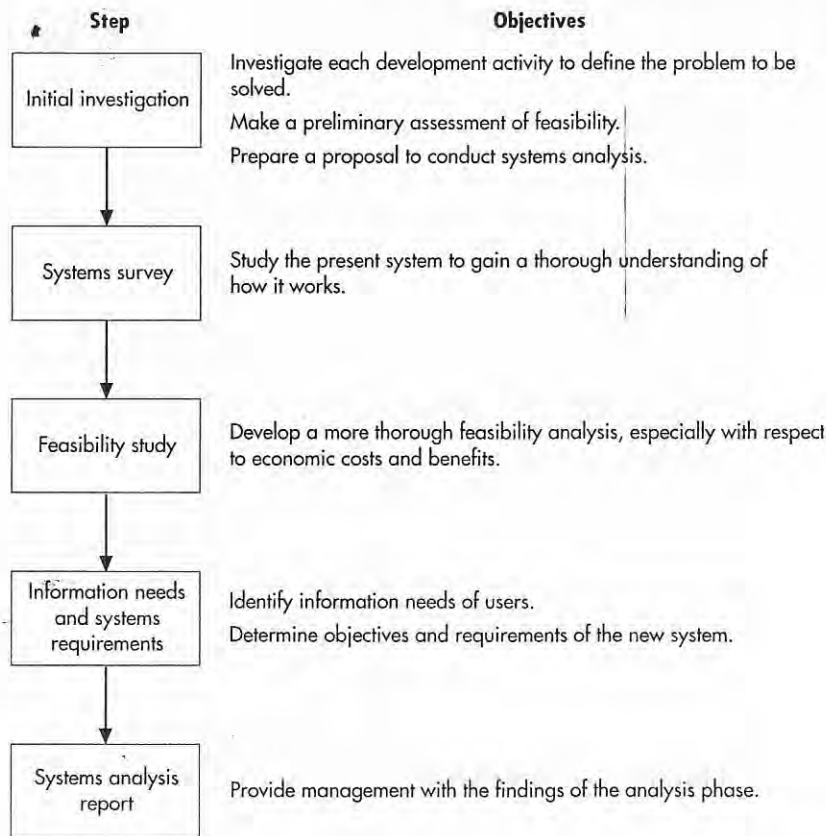


FIGURE 20-4
Steps in Systems Analysis

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 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 20-3 shows the information contents of a proposal to conduct systems analysis.

Systems Survey

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.

TABLE 20-3 Table of Contents for Reports Prepared During Systems Analysis at Shoppers Mart

Proposal to Conduct Systems Analysis	Systems Survey Report	Systems Analysis Report
Table of Contents	Table of Contents	Table of Contents
I. Executive Summary	I. Executive Summary	I. Executive Summary
II. System Problems and Opportunities	II. System Goals and Objectives	II. System Goals and Objectives
III. Goals and Objectives of Proposed System	III. System Problems and Opportunities	III. System Problems and Opportunities
IV. Project Scope	IV. Current System Operations	IV. Project Scope
V. Anticipated Costs and Benefits	A. Policies, Procedures, and Practices Affecting System	V. Relationship of Project to Overall Strategic Information Systems Plan
VI. Participants in Development Project	B. System Design and Operation (Intended and Actual)	VI. Current System Operations
VII. Proposed System Development Tasks and Work Plan	C. System Users and Their Responsibilities	VII. User Requirements
VIII. Recommendations	D. System Outputs, Inputs, and Data Storage	VIII. Feasibility Analysis
	E. System Controls	IX. System Constraints
	F. System Strengths, Weaknesses, and Constraints	X. Recommendations for New System
	G. Costs to Operate System	XI. Proposed Project Participants and Work Plan
	V. User Requirements Identified	XII. Summary
		XIII. Approvals
		XIV. Appendix of Documents, Tables, Charts, Glossary

Data about the current AIS is gathered from employees and from documentation such as organizational charts and procedures 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 20-4.

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.

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.

TABLE 20-4 Advantages and Disadvantages of Data-Gathering Methods

	Advantages	Disadvantages
Interviews	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Time-consuming Expensive Personal biases or self-interest may produce inaccurate information
Questionnaires	<ul style="list-style-type: none"> Can be anonymous Not time-consuming Inexpensive Allows more time to think about responses 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Can verify how system actually works, rather than how it should work Results in greater understanding of the system 	<ul style="list-style-type: none"> Time-consuming Expensive Difficult to interpret properly Observed people may alter behavior
Systems Documentation	<ul style="list-style-type: none"> Describes how system should work Written form facilitates review, analysis 	<ul style="list-style-type: none"> Time-consuming May not be available or easy to find

Systems documentation describes how the AIS 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 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 20-5 lists analysis and design tools and techniques used to create an AIS and identifies the chapter where each is discussed.

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 20-3 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

TABLE 20-5 Systems Analysis and Design Tools and Techniques

CASE (chapter 21)	Gantt charts (chapter 20)
Data dictionary (chapter 4)	PERT charts (chapter 20)
Data flow diagrams (chapter 3)	Prototyping (chapter 21)
Document flowcharts (chapter 3)	REA data models (chapter 17)
E-R diagrams (chapter 17)	Record layouts (chapter 4)
Forms design checklist (chapter 22)	System flowcharts (chapter 3)

descriptions, input and output descriptions, copies of documents, E-R diagrams, flowcharts, and data flow diagrams.

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

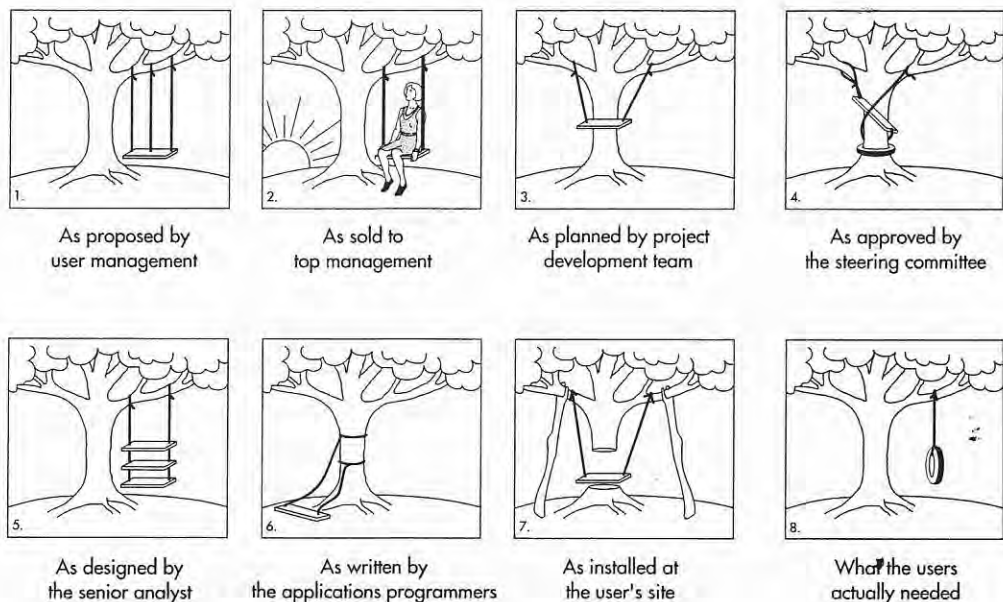
Once a project is deemed feasible, the company identifies the information needs of users and documents systems requirements. Table 20-6 is an example of systems requirements.

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 20-5 is a humorous view of the types of communication problems associated with this process.

TABLE 20-6 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

FIGURE 20-5
Communications
Problems in Systems
Analysis and Design



When Corning Corporation investigated the ophthalmic pressings it manufactures, it found that 35% of its drafting documents contained errors. Drafting errors are increasingly 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 20-7, 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.

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 21.

TABLE 20-7 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 it 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.

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 20-3, shows the information typically contained in the report.

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; 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 20-8) 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.

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 over \$3 million. The internal rate of return 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.

TABLE 20-8 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	160,000
Personnel costs	500,000	800,000	900,000	1,000,000	1,100,000	1,300,000	1,300,000
Communication charges	100,000	160,000	180,000	200,000	220,000	250,000	250,000
Overhead	300,000	420,000	490,000	560,000	600,000	640,000	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	\$2,000,000
Working capital savings	900,000	1,200,000	1,500,000	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	1,800,000
Warehousing efficiencies		400,000	800,000	1,200,000	1,600,000	2,000,000	2,000,000
Total savings	\$1,500,000	\$3,300,000	\$4,600,000	\$5,500,000	\$6,400,000	\$7,300,000	\$7,300,000
Savings minus recurring costs	\$540,000	\$1,390,000	\$2,400,000	\$3,035,000	\$3,700,000	\$4,300,000	\$4,300,000
Less income taxes (34% rate)	(183,600)	(472,600)	(816,000)	(1,031,900)	(1,258,000)	(1,462,000)	(1,462,000)
Cash savings (net of tax)	\$356,400	\$917,400	\$1,584,000	\$2,003,100	\$2,442,000	\$2,838,000	\$2,838,000
Savings on taxes due to depreciation deduction	340,000	544,000	326,400	195,500	195,500	98,600	98,600
Net savings	(\$5,000,000)	\$696,400	\$1,461,400	\$1,910,400	\$2,198,600	\$2,637,500	\$2,936,600

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

Net present value (interest rate of 10%):

Depreciation on initial investment of \$5,000,000:

	(5,000,000)	Tax Rate 34%			
		Year	Rate (%)	Depreciation	Tax Savings
$696,400 \times 0.9091 =$	633,097	1	20.00	\$1,000,000	\$340,000
$1,461,400 \times 0.8265 =$	1,207,847	2	32.00	1,600,000	544,000
$1,910,400 \times 0.7513 =$	1,435,284	3	19.20	960,000	326,400
$2,198,600 \times 0.6830 =$	1,501,644	4	11.50	575,000	195,500
$2,637,500 \times 0.6209 =$	1,637,624	5	11.50	575,000	195,500
$2,936,600 \times 0.5645 =$	1,657,711	6	5.80	290,000	98,600
Net present value is	\$3,073,207				
Internal rate of return is	25.04%				

With management's approval, she assures employees they will not lose their jobs and that all affected employees will be retained. 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) 601	program evaluation and review technique (PERT) 603	behavioral aspects of change 608
systems analysis 601	critical path 604	aggression 609
conceptual design 602	Gantt chart 604	projection 609
physical design 602	feasibility study 605	avoidance 609
implementation and conversion 602	economic feasibility 606	request for systems development 610
operations and maintenance 602	technical feasibility 606	initial investigation 610
information systems steering committee 602	legal feasibility 606	proposal to conduct systems analysis 611
systems analyst 603	scheduling feasibility 606	systems survey 611
computer programmer 603	operational feasibility 606	systems documentation 613
project development plan 603	capital budgeting model 607	physical models 613
master plan 603	payback period 607	logical models 613
	net present value (NPV) 607	systems survey report 613
	internal rate of return (IRR) 607	systems analysis report 616

AIS IN ACTION

Chapter Quiz

1. Which of the following is NOT a reason why companies make changes to their AIS?
 - a. gain a competitive advantage
 - b. increase productivity
 - c. keep up with business growth
 - d. downsize company operations
 - e. All of the above are reasons why companies change an AIS.

2. Which of the following is the planning technique that identifies implementation activities and their relationships, constructs a network of arrows and nodes, and then determines the critical path through the network?

a. Gantt chart	c. physical model
b. PERT diagram	d. data flow diagram

3. The purchasing department is designing a new AIS. Who is best able to determine departmental information requirements?

a. steering committee	c. top management
b. controller	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	c. systems development life cycle
b. master plan	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. Increased error rates, disruptions, and sabotage are examples of which of the following?
 - a. aggression
 - b. avoidance
 - c. projection
 - d. payback
8. What is often the most significant problem a company encounters in designing, developing, and implementing a system?
 - a. the human element
 - b. technology
 - c. legal challenges
 - d. planning for the new system
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 is NOT one of the tangible or intangible benefits a company might obtain from a new system?
 - a. cost savings
 - b. improved customer service and productivity
 - c. improved decision making
 - d. improved data processing
 - e. All are benefits of a new system.

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

- 20.1. 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.
- 20.2. You are a consultant advising a firm on the design and implementation of a new system. Management has decided to let several employees go after the system is implemented. Some have many years of company service. How would you advise management to communicate this decision to the affected employees? To the entire staff?
- 20.3. While reviewing a list of benefits from a computer vendor's proposal, you note an item that reads, "Improvements in management decision making—\$50,000 per year." How would you interpret this item? What influence should it have on the economic feasibility and the computer acquisition decision?
- 20.4. For the following, discuss which data-gathering method(s) are most appropriate and why:
- Examining the adequacy of internal controls in the purchase requisition procedure
 - Identifying the controller's information needs
 - Determining how cash disbursement procedures are actually performed
 - Surveying employees about the move to a total quality management program
 - Investigating an increase in uncollectible accounts
- 20.5. The following problems occurred in a manufacturing firm. What questions should you ask to understand the problem?
- Customer complaints about product quality have increased.
 - Accounting sees an increase in the number and dollar value of bad-debt write-offs.
 - Operating margins have declined each of the past four years because of higher-than-expected production costs from idle time, overtime, and reworking products.
- 20.6. Give some examples of systems analysis decisions that involve a trade-off between each of the following pairs of objectives:
- economy and usefulness
 - economy and reliability
 - economy and customer service
 - simplicity and usefulness
 - simplicity and reliability
 - economy and capacity
 - economy and flexibility
- 20.7. For years, Jerry Jingle's dairy production facilities have led the state in sales volume, but recent declines worry him. Customers are satisfied with his products but are troubled by the dairy's late deliveries and incomplete orders. Production employees (not the cows) are concerned about bottlenecks in milk pasteurization and homogenization due to poor job scheduling, mix-ups in customers' orders, and improperly labeled products. How should Jerry address the problems? What data-gathering techniques would be helpful at this early stage?
- 20.8. A manufacturing firm needed a specialized software program to identify and monitor cost overruns. After an extensive analysis, the company purchased prepackaged software and assigned three programmers to modify it to meet its individual circumstances and processes. After six months of work, during final testing, the company told the programmers to stop all work until further notice. While reading the software vendor's sales agreement, the manufacturing manager found a clause stating that the software could not be changed without the prior written consent of the vendor. The firm had to pay the software vendor an additional fee so it could use the modified software in its manufacturing process. Which aspect(s) of feasibility did the manufacturing firm fail to consider prior to purchasing the software?

- 20.9. 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

- 20.1. How do you get a grizzled veteran police officer who is used to filling out paper forms to use a computer to process his arrests and casework—especially when he has little or no experience using a computer? That was the problem facing the Chicago Police Department when it decided to implement a relational database system. The system is capable of churning through massive amounts of data to give officers the information they need to fight crime more effectively.

Initially, the department rolled out the case component of the CLEAR (Citizen Law Enforcement Analysis and Reporting) system that provided criminal history and arrest records. The officers hated it, complaining that the system was not user-friendly, that approval from supervisors was complex and involved multiple screens, and that they did not feel properly trained on the system. After listening to the officers' complaints for a year, the department clearly had to do something. (*Adapted from Todd Datz, "No Small Change," CIO (February 15, 2004): 66–72*)

Required

- Identify as many system analysis and design problems as you can.
 - What could the department have done differently to prevent the officers' complaints?
 - What principles of system analysis and design were violated in this case?
- 20.2. 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 regarding 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?
- 20.3. Wright Company's information system was developed in stages over the past five years. During the design process, department heads specified the information and reports they needed. By the time development began, new department heads were in place, and they requested additional reports. Reports were discontinued only when requested by a department head. Few reports were discontinued, and a large number are generated each period.

Management, concerned about the number of reports produced, asked internal auditing to evaluate system effectiveness. They determined that more information was generated than could be used effectively and noted the following reactions:

- Many departments did not act on reports during peak activity periods. They let them accumulate in the hope of catching up later.
- Some had so many reports they did not act at all or misused the information.
- Frequently, no action was taken until another manager needed a decision made. Department heads did not develop a priority system for acting on the information.
- Department heads often developed information from alternative, independent sources. This was easier than searching the reports for the needed data.

Required

- a. Explain whether each reaction is a functional or dysfunctional behavioral response.
 - b. Recommend procedures to eliminate dysfunctional behavior and prevent its recurrence. (*CMA Examination, adapted*)
- 20.4.  The controller of Tim's Travel (TT) is deciding between upgrading the company's existing computer system or replacing it with a new one. Upgrading the four-year-old system will cost \$97,500 and extend its useful life for another seven years. The book value is \$19,500, although it would sell for \$24,000. Upgrading will eliminate one employee at a salary of \$19,400; the new computer will eliminate two employees. Annual operating costs are estimated at \$15,950 per year. Upgrading is expected to increase profits 3.5% above last year's level of \$553,000.

The BetaTech Company has quoted a price of \$224,800 for a new computer with a useful life of seven years. Annual operating costs are estimated to be \$14,260. The average processing speed of the new computer is 12% faster than that of other systems in its price range, which would increase TT's profits by 4.5%.

Tim's present tax rate is 35%, and the cost of financing is 11%. After seven years, the salvage value, net of tax, would be \$12,000 for the new computer and \$7,500 for the present system. For tax purposes, computers are depreciated over five full years

(six calendar years; a half year the first and last years), and the depreciation percentages are as follows:

Year	Percent (%)
1	20.00
2	32.00
3	19.20
4	11.52
5	11.52
6	5.76

Required

Using a spreadsheet package, prepare an economic feasibility analysis to determine whether TT should rehabilitate the old system or purchase the new computer. As part of the analysis, compute the after-tax cash flows for years 1 through 7 and the payback, NPV, and IRR of each alternative.

- 20.5. 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.

- 20.6. A recently completed feasibility study to upgrade XYZ's computer system shows the following benefits. Compensation figures in parentheses include wages, benefits, and payroll taxes.



1. Production

- Market forecasts, which take two \$400 person-days a month, will be more accurate with software making the calculations.
- Effective inventory control will prevent part stockouts and reduce inventory by \$1,000,000. XYZ's cost of capital is 20%.
- Detailed evaluations of plan changes will increase production flexibility, reduce sales losses, and eliminate two clerks (\$75,000 each).

2. Engineering

- Computerized updating of bills of material and operations lists will save 40% of an engineer's (\$100,000) and 25% of a clerk's (\$60,000) time.
- Computerized calculations of labor allocations, rates, and bonus details will save 40% of a clerk's (\$80,000) time.

3. Sales. Improved reporting will enable the five-person sales staff to react more quickly to the market, producing a \$10,000 per person sales increase.

4. Marketing. Revised reports and an improved forecasting system will increase net income by \$50,000.

5. Accounting

- Quickly determining new product costs will save 30% of the accountant's (\$100,000) time.
- An incentive earnings system will save 40% of the payroll clerk's (\$60,000) time.

Required

As a board member, which of the benefits can you defend as relevant to the system's cost justification? Calculate how much XYZ will save with the new system.

(SMAC Examination, adapted)



- 20.7. The following list presents specific project activities and their scheduled starting and completion times:

Activity	Starting Date	Ending Date
A	Jan. 5	Feb. 9
B	Jan. 5	Jan. 19
C	Jan. 26	Feb. 23
D	Mar. 2	Mar. 23
E	Mar. 2	Mar. 16
F	Feb. 2	Mar. 16
G	Mar. 30	Apr. 20
H	Mar. 23	Apr. 27

Required

- Using a format similar to that in Figure 20-3, prepare a Gantt chart for this project. Assume that each activity starts on a Monday and ends on a Friday.
 - Assume that today is February 16 and that activities A and B have been completed, C is half completed, F is a quarter completed, and the other activities have not commenced. Record this information on your Gantt chart. Is the project behind schedule, on schedule, or ahead of schedule? Explain.
 - Discuss the relative merits of the Gantt chart and PERT as project planning and control tools.
- 20.8. Recent years have brought an explosive growth in electronic communication. Laptops, netbooks, e-readers, personal digital assistants, sophisticated cell phones, fax machines, e-mail, teleconferencing, office productivity software, and sophisticated management information systems have changed the way information is received, processed, and transmitted. With the decreasing costs of computer equipment and the increasing power of automation, the full impact of computerization has yet to be felt. Although the development of computer applications is directed at being user friendly or user oriented, the integration of computers into the organization has had both positive and negative effects on employees.

Required

- Describe the benefits companies and employees receive from electronic communications.
 - Discuss the organizational impact of introducing new electronic communication systems.
 - Explain (1) why an employee might resist the introduction of electronic communication systems and (2) the steps an organization can take to alleviate this resistance.
(CMA Examination, adapted)
- 20.9. PWR manufactures precision nozzles for fire hoses. Ronald Paige, an engineer, started the corporation and it has experienced steady growth. Reporting to Ronald are six vice presidents representing marketing, production, research and development, information services, finance, and human resources. The information services department was established last year when PWR began developing a new information system consisting of a server connected to each employee's personal computer. The PCs can download and upload data to the server. PWR is still designing and developing applications for its new system. Ronald received a letter from the external auditor and called a meeting with his vice presidents to review the recommendation that PWR form an information systems steering committee.

Required

- a. Explain why the auditors would recommend an information systems steering committee, and discuss its specific responsibilities. What advantages can the committee offer PWR?
- b. Identify the PWR managers most likely to serve on the committee. (*CMA Examination, adapted*)

- 20.10. 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*)

- 20.11. Don Richardson, JEM Corporation's vice president of marketing, is part of a management team that for several months has been discussing plans to develop a new line of business. Rumors about the major organizational changes that may be required to implement the strategic plan have been circulating for months.

Several employees who are anxious about the expected changes confronted Don. The sales manager said, "It is imperative that we speak to you right away. The employees are very apprehensive about the proposed changes, and their job performance has slacked off." The accounting manager added, "That's right. My staff are asking me all sorts of questions about this new line of business, and I don't have any answers for them. They're not buying the 'We will make an official announcement soon' line any longer. I suspect that some of them are already looking for jobs in case the department changes phase out their positions."

Implementing organizational change is one of the most demanding assignments an executive faces. It has been suggested that every change requires three steps: unfreezing the current situation, implementing the change, and refreezing the effected change. This view, however, lacks the specific details needed by an operating manager who must initiate the change.

Required

- a. Explain why employees resist organizational change.
- b. Discuss ways JEM Corporation can alleviate employee resistance to change. (*CMA Examination, adapted*)

- 20.12. Remnants, Inc., with headquarters in St. Louis, manufactures designer clothing. The company markets and services its products by region, with each functioning as a profit center. Each region has a manager, an accounting department, a human resources department, and several area offices to market and service the products. Each area office has sales, service, and administrative departments whose managers report to an area manager.

The New York area office departed from the standard organizational structure by establishing a branch office to market and service the firm's products in Boston. A branch manager who reports directly to the New York area manager heads the local office.

The Boston branch manager is encouraging the New York area manager to consider a new information system to handle the local branch's growing information needs. The New York area manager and the eastern region manager want to establish a project team with employees from the region, area, and branch office. The team will assess the information needs at the Boston branch office and develop system

recommendations. The following employees have been appointed to the project team, with Keith Nash as chairperson:

Eastern Region Office

Kurt Johnson, Budget Supervisor
Sally Brown, Training Director

New York Area Office

Keith Nash, Administrative Director

Boston Branch

Heidi Meyer, Branch and Sales Manager
Bobby Roos, Assistant Branch and Service Manager
Joe Gonzalez, Salesperson
Juana Martinez, Serviceperson

Required

- a. Project team members contribute their skills to help accomplish a given objective. Characteristics of group members can influence the functioning and effectiveness of a project team. Identify some of these characteristics.
 - b. Given the team's composition, what sources of conflict can you see arising among its members? Do you think the group will succeed in its objective to develop an IS for the Boston branch office? Why or why not?
 - c. What contribution would a budget supervisor make in a project team?
- 20.13. Managers at some companies face an ongoing systems development crisis: IS departments develop systems that businesses cannot or will not use. At the heart of the problem is a "great divide" that separates the world of business and the world of IS. Few departments seem able or ready to cross this gap.

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 the widespread use of PC-based systems that have spawned high user expectations that IS departments are not meeting. Users seek more powerful applications than are available on many older systems.

The costs of the great divide can be devastating. An East Coast chemical company spent over \$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. 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 is the great divide in the systems development process? What causes the gap?
 - b. What would you suggest to solve this information crisis?
 - c. Discuss the role a systems designer, business manager, and end user can take to narrow the great divide.
 - d. Who plays the most vital role in the effective development of the system?
- 20.14. 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?

Case 20-1 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 reason why companies make changes to their AIS?
 - a. gain a competitive advantage [AIS changes can help a company increase the quality, quantity, and speed of information, which leads to improved decision making and a greater competitive advantage.]
 - b. increase productivity [Using computers in an AIS can automate repetitive tasks, which allows more work to be done in the same amount of time. This increases productivity.]
 - c. keep up with business growth [As a company grows, its old system will likely not be able to handle the increase in demand and thus will require changes to the AIS to accommodate the growth.]
 - d. downsize company operations [A smaller company requires a smaller AIS. For instance, downsizing may prompt a company to move from centralized decision making to decentralized decision making. As a result, the AIS would most likely shift from using a mainframe computer to a set of networked workstations.]
 - ▶ e. All of the above are reasons why companies change an AIS. [Correct.]
2. Which of the following is the planning technique that identifies implementation activities and their relationships, constructs a network of arrows and nodes, and then determines the critical path through the network?
 - a. Gantt chart [Incorrect. A Gantt chart is a bar chart that displays dates and stages of completion for each project task. See Figure 20-3.]
 - ▶ b. PERT diagram [Correct.]
 - c. physical model [Incorrect. A physical model illustrates how a system functions. It describes document flows, computer processes, equipment used, and other physical elements of the system.]
 - d. data flow diagram [Incorrect. A data flow diagram is used to document a system with four basic symbols—i.e., squares, circles, parallel lines, and arrows.]
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 detailed 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 20-4.]
 - b. determination of information needs and system requirements, system survey, feasibility study, initial investigation [Incorrect. See Figure 20-4.]
 - c. system survey, initial investigation, determination of information needs and system requirements, feasibility study [Incorrect. See Figure 20-4.]
 - ▶ d. initial investigation, system survey, feasibility study, determination of information needs and system requirements [Correct. See Figure 20-4.]

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. Increased error rates, disruptions, and sabotage are examples of which of the following?
 - ▶ a. aggression [Correct. These are classic symptoms of aggression as a reaction to change.]
 - b. avoidance [Incorrect. Avoidance is best illustrated by the statement that if a person does not use the new system, maybe it will go away.]
 - c. projection [Incorrect. Projection refers to blaming all problems on the new system.]
 - d. payback [Incorrect. Payback is an economic feasibility metric.]
8. What is often the most significant problem a company encounters in designing, developing, and implementing a system?
 - ▶ a. the human element [Correct. A system will fail without the support of the people it is designed to serve—for a variety of reasons, including fear of change, poor communication and training, disruption of work, and lack of top-management support.]
 - b. technology [Incorrect. The technology a system employs is normally tested for functionality prior to its implementation in a new system.]
 - c. legal challenges [Incorrect. With proper system planning and design, systems can meet all laws and regulations.]
 - d. planning for the new system [Incorrect. Proper planning can actually prevent problems from occurring.]
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 is NOT one of the tangible or intangible benefits a company might obtain from a new system?
 - a. cost savings [Although this answer is correct, there are other correct answers. Automated systems can reduce clerical costs, as well as other related costs.]

- b. improved customer service and productivity [Although this answer is correct, there are other correct answers. New systems can integrate data from several sources to provide fast, reliable information to assist customers and increase productivity.]
- c. improved decision making [Although this answer is correct, there are other correct answers. Better information greatly increases the likelihood of better decisions.]
- d. improved data processing [Although this answer is correct, there are other correct answers. Better-designed systems using newer technology improve data processing and reduce the likelihood of human error.]
- ▶ e. All are benefits of a new system. [Correct.]

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 20-9 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 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 20-9 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 20-10, which shows cumulative net cash flow totals, indicates that breakeven occurs during year 4. To 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 takes 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 20-11, RSSA's NPV is \$262,100 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 a 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 20-9 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 Outflows	-\$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

TABLE 20-10 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					

TABLE 20-11 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%					