PART FIVE

SPECIAL TOPICS IN ACCOUNTING INFORMATION SYSTEMS

The primary emphasis throughout this textbook has been the impact of technology on AISs. These next three chapters of the book highlight specific areas of technology that impact accountants, and should therefore be particularly interesting to accounting students.

Chapter 13 describes the process of developing and implementing effective AISs. The process is not that much different from implementing any type of IT, and it often follows the traditional systems development life cycle. The chapter describes each phase of this cycle, emphasizes the special nature of AISs, and identifies the accountant's role in systems development and implementation.

Chapters 10, 11, and 12 of this book emphasized information systems security and control. Chapter 14 continues that discussion, analyzing some of the important auditing activities associated with computerized AISs and discussing the role of the IT auditor. The chapter also describes important topics of interest to IT auditors today, including IT governance, auditing for fraud, the Sarbanes-Oxley Act of 2002, and third-party information systems reliability assurances.

Chapter 15 discusses the impact of the Internet and electronic commerce on accountants. As an increasing number of business organizations engage in electronic commerce, it becomes critical for accountants to understand the fundamentals of doing business electronically. Chapter 15 describes the technology that underlies the Internet and electronic commerce, including a comprehensive discussion of XBRL and how this reporting language is changing financial reporting. The chapter also discusses intranets and extranets as well as general categories of electronic commerce, such as retail sales. The chapter concludes by identifying a number of privacy and security issues for business enterprises engaged in electronic commerce.

Chapter 13

Developing and Implementing Effective Accounting Information Systems

After reading this chapter, you will:

1. *Understand* the roles of accountants, analysis teams, and steering committees in systems studies.
2. *Understand* why systems analysts must understand the strategic and operational goals of a company.
3. *Become familiar with* the deliverables in systems analysis work, especially the systems analysis report.
4. *Be able to* help plan and complete the analysis and design phases of a systems study.
5. *Know* what a feasibility evaluation is and how to conduct it.
6. *Understand* some of the costs, benefits, tools, and techniques associated with systems design work.
7. *Be able to* evaluate alternative systems proposals and make a selection or choose to outsource.
8. *Be familiar with* the activities required to implement and maintain a large information system.

"Analysts, programmers, and other IT specialists frequently refer to 'my system.' This attitude has, in part, created an 'us versus them' conflict between technical staff and their users and management."

Jeffrey L. Whitten and Lonnie D. Bentley, *Systems Analysis and Design Methods*, 7E, McGraw-Hill Irwin, 2007, p. 72.

INTRODUCTION

IT governance, part of an organization's overall mission, goals, policies, and procedures, is the process of ensuring that IT is used effectively, efficiently, and strategically. A comprehensive IT strategy requires careful systems study and should prioritize the acquisition or development of various information systems, including operating and application systems, such as accounting information systems.

The IT systems study includes planning and analysis through development, implementation, and a feedback loop for each new IT application. Some systems will be designed in-house, while others may be purchased or leased. Selecting a system among alternatives is part of the IT systems study process. In some cases, a company may decide to outsource part or all of their IT.

As the quote at the top of this page suggests, a systems study should not just be conducted by ''systems people.'' Developing effective, strategic information systems is the job of systems programmers, analysts, designers, users, and managers. Accountants, as auditors and general information users, should be involved with all IT studies, especially accounting information systems.

SYSTEMS DEVELOPMENT LIFE CYCLE

As you might imagine, studying a large AIS is a large and difficult task. A **systems study** (also called *systems development work*) begins with a formal investigation of an existing information system. Who actually performs a systems study? This varies from company to company as well as among projects. Many large organizations have in-house professionals to perform this work. In contrast, smaller organizations with limited technical expertise as well as larger organizations with other priorities for their internal experts are more likely to hire a team of outside consultants for this work. (Note: The Sarbanes-Oxley Act of 2002 expressly forbids CPA firms from performing such systems work for a client with whom it already has an audit relationship.) Our discussion assumes that most of the work is performed by a generic ''study team'' of experts, who may or may not be outside consultants.

Four Stages in the Systems Development Life Cycle

Traditionally, we can identify four major steps or phases of a systems study:

1. **Planning and Investigation** This step involves performing a preliminary investigation of the existing system, organizing a systems study team, and developing strategic plans for the remainder of the study.

2. **Analysis** This step involves analyzing the company's current system in order to identify the information needs, strengths, and weaknesses of the existing system.
3. **Design** In this step, an organization designs changes that eliminate (or minimize) the current system's weak points while preserving its strengths.
4. **Implementation, Follow-up, and Maintenance** This phase includes acquiring resources for the new system as well as training new or existing employees to use it. Companies conduct follow-up studies to determine whether the new system is successful and, of course, to identify any new problems with it. Finally, businesses must maintain the system, meaning correcting minor flaws and updating the system as required.

These four phases are the **system development life cycle (SDLC)** of a business information system. Figure 13-1 illustrates that this life cycle spans the time during which a company's system is operating normally and is subsequently revised as a result of some problem (or problems). Each time a newly revised system takes over the company's daily operating activities, a new life cycle begins.

The dashed arrows in Figure 13-1 emphasize that follow-up studies of a system should be a continuous process. An organization reevaluates systems regularly to confirm they are still working well. If follow-up studies indicate that previous problems have recurred or new ones have developed, an organization should take the dashed-arrow route from the follow-up studies to the recognition of systems problems and begin a new systems study. In practice there is usually much overlap between phases in the life cycle, and the steps in a systems study don't necessarily occur in sequence. Often, system developers will perform two or more stages simultaneously or in parallel with each other.

Systems Studies and Accounting Information Systems

A systems study looks at all IT in an entity's **applications portfolio**. This portfolio may include an enterprise system, along with other specialized information systems, or it may consist of many separate systems for functional areas such as accounting, marketing, and human resources. Accounting information systems (AISs) are prime targets for systems

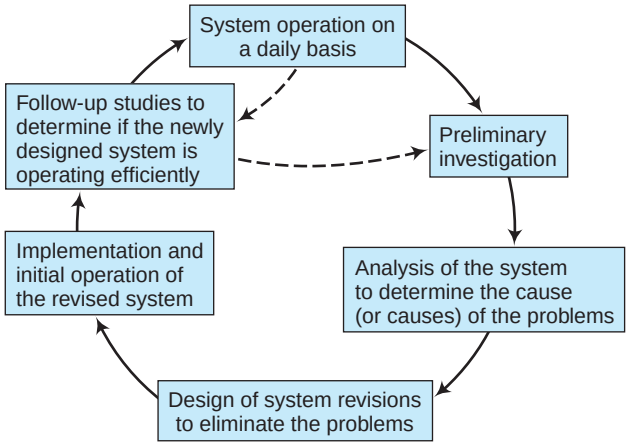

FIGURE 13-1 System development life cycle of a business information system.

studies—for example, because they may not currently support electronic commerce or do not integrate data efficiently in data warehouses. But in general, a systems study means more than just replacing or modifying existing information systems. Typically, altering an information system also affects work flows, data gathering and recording tasks, employee responsibilities, and even the way an organization rewards its managers. Thus, one reason why organizations perform systems studies is because such studies are part of the greater task of reengineering one or more of its core systems.

SYSTEMS PLANNING

The first phase of a systems study involves systems planning and an initial investigation.

Planning for Success

In large organizations, system redesigns (or new development work) typically involve millions of dollars, making mistakes very costly. In smaller organizations, major errors can be catastrophic, leading a firm to bankruptcy. What else can happen when organizations do not plan carefully? Here are some examples:

- Systems do not meet users' needs, causing employee frustration, resistance, and even sabotage.
- Systems are not flexible enough to meet the business needs for which they were designed and are ultimately scrapped.
- Project expenditures significantly overrun what once seemed like very adequate budgets.
- The time required to complete the new system vastly exceeds the development schedule—often by years.
- Systems solve the wrong problems.
- Top management does not approve or support the new systems.
- Systems are difficult and costly to maintain.

Studies of unsuccessful information systems projects suggest that mistakes made at the outset of a systems study are the most common reason why such projects ultimately fail. Careful systems planning and an initial investigation can avoid critical missteps that lead to disaster. ''Planning for success'' means beginning a systems study with a focused investigation that: (1) approaches specific organizational problems from a broad point of view, (2) uses an interdisciplinary study team to evaluate an organization's information systems, and (3) makes sure the company's study team works closely with a steering committee (described below) in all phases of the work.

Case-in-Point 13.1 In a recent study of why systems development projects fail, the Standish Group found that only about half the components initially specified for a new system were actually created, and that about the same percentage of the functionality that *was* created was actually used. The most common problem: poorly defined requirements. "If a project can't get a handle on the basic system requirements," the report concluded, "it is doomed to fail."[1]

[1]Charles Babcock. ''The Art of Defining Software Requirements,'' *Information Week* (March 15, 2004).

Broad Viewpoint in a Systems Study. When performing a systems study, the participants should use a **systems approach**, that is, a broad point of view. This approach aligns the systems study with the organization's mission and strategic planning goals and objectives. For example, if a company plans to consolidate divisions or discontinue unprofitable product lines, new IT systems will need to reflect these plans. In another scenario, a company that is embarking on a growth strategy through merger and acquisition should think twice about implementing a new enterprise system that could be incompatible with newly acquired companies. Also, management should think strategically about whether a potential new system could accommodate acquired businesses operating in different industries.

The Study Team and the Steering Committee. Using an interdisciplinary study team follows from the need for a broad viewpoint when performing a systems study. It also serves to correct the problem identified in our chapter quote—thinking that the system belongs only to the IT staff. Because most accounting and computer professionals are specialists, it is unlikely that any one or two people will have the broad background and experience necessary to understand and change a large AIS. For this reason, the recommended approach is to form (or hire) a team of specialists—a ''study team''—to perform the system's study.

It is important that the study team communicate closely and meaningfully with the company's top managers. To provide this continuous interface, the company's top management should also appoint a **steering committee** to work with each study team as it performs its tasks. Ideally, the committee will include top management personnel—for example, the controller, the vice president of finance, the top-level information systems manager (information systems vice president or chief information officer), perhaps one or more staff auditors, and (for very important projects) even the chief executive officer of the company. The rationale for such involvement is straightforward: *top management commitment is critical to the ultimate success of a new or revised system*.

Investigating Current Systems

Planning for IT includes constant monitoring of current systems. When any appear to have problems, the systems study team performs a **preliminary investigation** of the system in question and advises the steering committee of its findings. One important part of this work is to separate symptoms from causes. In its deliberations, the study team may consider alternatives to the current system, attempt to estimate the costs and benefits of its proposed solutions, or make recommendations for desired alternatives. In this phase of the project, the study team enjoys wide latitude in what it can choose to examine, and it is usually encouraged to ''think outside the box'' (i.e., to consider vastly different and innovative approaches to address current problems).

The duration of a preliminary investigation is comparatively brief—typically, a matter of a few weeks. The ''deliverable'' from this phase of the systems study is a preliminary investigation report describing the problems or objectives the study team identified, solutions or alternatives it investigated, and further course(s) of action it recommends. The study team submits this report to the company steering committee for a final determination. The steering committee may decide to: (1) disband the study team and do nothing, (2) perform further preliminary investigations, or (3) proceed to the formal systems analysis stage of the systems study.

SYSTEMS ANALYSIS

The basic purpose of the **systems analysis** phase is to examine a system in depth. The study team will familiarize itself with the company's current operating system, identify specific inputs and outputs, identify system strengths and weaknesses, and eventually make recommendations for further work. Figure 13-2 shows the logical procedures that the team should follow.

In performing its work, the study team should strive to avoid overanalyzing a company's system. Instead, the team should try to identify and understand the organization's goals for the system, perform a systems survey, and prepare one or more reports that describe its findings.

Understanding Organizational Goals

For the study team to do an adequate job—for example, determine the real problems within a company's information system—its members must first understand the system's goals. Of special importance is determining which goals are not being achieved under the present system and why this happens. Organization goals include: (1) general systems goals, (2) top management systems goals, and (3) operating management systems goals.

General Systems Goals. General systems goals apply to most organization's information systems and help an AIS contribute to an efficient and effective organization. Principles contributing to these goals are: (1) awareness that the benefits of the new system should exceed the costs, (2) concern that the output of the system helps managers make better decisions, (3) commitment to designing a system that allows optimal access to information, and (4) flexibility so that the system can accommodate changing information needs.

The study team must determine whether the current information system helps to achieve general systems goals. For example, if an AIS has excessive costs associated with using traditional paper documents (e.g., purchase orders, receiving reports, and vendor invoices), this will violate goal number one (cost awareness), and the study team might recommend that the company use a web-based system instead.

Top Management Systems Goals. AISs typically play key roles in satisfying top management goals. For instance, AISs usually provide top managers with long-range budget planning data so they can make effective strategic decisions regarding future product-line

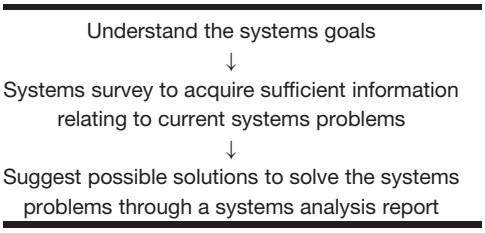

FIGURE 13-2 Systems analysis procedures.

sales or comparable business activities. Similarly, periodic performance reports provide top management with vital control information about corporate operations, such as how sales of new product lines are doing. Finally, top management needs to know about the short-range operating performance of its organization's subsystems—for example, summary information about individual department operating results and how these results compare with budgetary projections.

Operating Management Systems Goals. Compared to top management, the information needs of operating managers (i.e., managers working within specific organizational subsystems) are normally easier to determine. This is because the decision-making functions of operating managers typically relate to well-defined and narrower organizational areas. In addition, the majority of operating managers' decisions are for the current business year (in contrast to top management's long-range decision-making functions). Much of the information required for operating managers' decisions is generated internally as a by-product of processing a company's accounting data.

> ***Case-in-Point 13.2*** Grupo Financiero Bital is a Mexican bank with almost 1,200 branches, 3 million customers, and $9 billion in assets. To work effectively, branch managers need access to information about customer accounts at other branches. At one point in time, managers could ask Bital's massive databases for information, but the output was sometimes a 500-page report instead of the specific information a manager required. A redesign of this information system resulted in a corporate intranet. The intranet lets branch managers and top managers access exactly the data they needed to view performance measures of the individual branches. The company is realizing many indirect benefits from the new system and saves almost $6,000 per month in printing costs alone![2]

Systems Survey Work

The objective of a **systems survey** is to enable the study team to obtain a more complete understanding of the company's current operational information system and its environment. Of special importance is identifying the strengths and weaknesses of the current system. The overall objective is to retain the system's strengths while eliminating the system's weaknesses, especially those weaknesses causing problems in the current system. These weaknesses will likely relate to specific goals that the current system does not now accomplish.

Understanding the Human Element and Potential Behavioral Problems. Because the appearance of a study team on the work scene usually signals change, employees are often resistant to help. Unless the study team deals directly with this problem at the beginning, there is a good chance that employees will oppose the changes that the team recommends. In short, a systems study must gain the full cooperation and support of those employees who are crucial to the effectiveness of a new system. The best designed system ''on paper'' is likely to cause behavioral problems when implemented if the system does not have wide user support.

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[2]http://itmanagement.earthweb.com/erp/article.php/602201 (Intranets Give New Life, Accessed December 8, 2008).

Data Gathering. A systems survey requires the study team to gather data about the existing system. There are several ways of doing this, including:

- **Review Existing Documentation.** This documentation includes descriptive data such as organizational charts, strategic plans, budgets, policy and procedure manuals, job descriptions, and charts of accounts, as well as technical documentation such as flowcharts, process diagrams, and training manuals.
- **Observe the Current System in Operation.** Visiting various parts of the operation on a surprise schedule and asking workers questions about their jobs can be extremely helpful in learning whether the systems work as described, as well as discovering the morale of employees, occurrence of down-time, and workload cycles and distribution.
- **Use Questionnaires and Surveys.** These can be anonymous so that respondents share their views openly about sensitive issues. *Open-ended questionnaires* provide an unstructured free-flow of ideas that may bring new issues to light. *Close-ended questionnaires* (Figure 13-3), on the other hand, are efficient and allow for easy tabulation of results.
- **Review Internal Control Procedures.** In earlier chapters of this book, we discussed the importance of internal control systems. Weaknesses in these procedures can cause major problems for a company. The study team should identify high-risk areas, strengths, and weaknesses of the specific procedures.
- **Interview System Participants.** Face-to-face interviews allow the study team to gather system information in the greatest depth and sometimes reveal surprises. For example, an interview might reveal that a manager's decisions don't really require input from several existing reports.

Data Analysis

Once the study team completes its survey work, they must analyze the results. Often, this means nothing more than creating summary statistics, but it can also involve developing flowcharts and/or process maps that can highlight bottlenecks in information flows, redundant reporting, and missing information links.

Systems analysis work necessarily takes longer than a preliminary investigation, typically months. Where required, the study team will provide interim reports to the steering

Example of an Open-Ended Question on a Systems Survey Questionnaire:

Please explain why you are either satisfied or dissatisfied with the current general ledger system.

Example of a Closed-Ended Question on a Systems Survey Questionnaire:

Please indicate your level of satisfaction with the current general ledger system by checking the appropriate response below:

_____ Very satisfied
_____ Somewhat satisfied
_____ Neither satisfied nor dissatisfied
_____ Somewhat dissatisfied
_____ Very dissatisfied

FIGURE 13-3 Sample questions on a systems survey questionnaire.

committee about its progress. The most important deliverable from the analysis portion of the systems study, however, is the *final systems analysis report*, which signals the end of the analysis phase of the systems study. Like other reports, the study team submits this report to the steering committee, which then considers the report's findings and debates the recommendations it contains.

As representatives of top management, the steering committee has, within limits, the ability to make a decision. The committee could abandon the project, ask for additional analyses and a set of revised recommendations, or vote to proceed to the systems design phase of the project.

Evaluating System Feasibility

After obtaining a positive response from the steering committee, the design team must perform a detailed investigation of different potential systems. Figure 13-4 shows that this work involves five major procedures or activities. The first of these is a **feasibility evaluation** in which the design team determines the practicality of alternative proposals. Only after this step is completed can the design team tackle the other steps. For each system alternative, the design team must examine five feasibility areas: (1) technical feasibility, (2) operational feasibility, (3) schedule feasibility, (4) legal feasibility, and (5) economic feasibility.

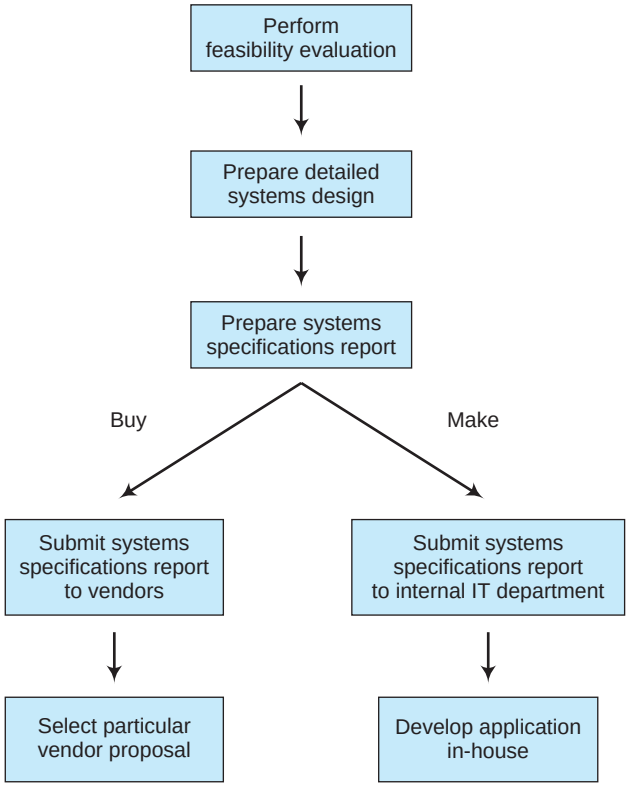

FIGURE 13-4 Steps in the systems design phase of a systems study.

Technical Feasibility. The **technical feasibility** of any proposed system attempts to answer the question, ''What technical resources are required by a particular system?'' Hardware and software are obvious components. A proposed system that can interface with critical existing software is more desirable than one requiring the organization to buy new software. Experts in computer systems typically work on this phase of the feasibility evaluation because a thorough understanding of IT is essential.

In addition to developing a preliminary hardware configuration for a proposed system, the design team must also determine whether current employees have the technical skills to use it. If a specific computerized system is too sophisticated for a company's employees, it is unlikely that using it in subsequent daily operations will be successful without appropriate training.

Operational Feasibility. The **operational feasibility** of a proposed system examines its compatibility with the current operating environment. That is, how consistent will the tasks and procedures required by the new system be with those of the old system? The design team must analyze the capabilities of current employees to perform the specific functions required by each proposed system and determine to what extent employees will require specialized training.

Operational-feasibility analysis is mostly a human relations study because it is strongly oriented toward ''people problems.'' For this reason, the participation of human-relations specialists is critical. As noted earlier, employees commonly have negative attitudes toward changes that might affect their organizational duties. If managers encourage employees to suggest changes and keep them well-informed about how any new system will affect their job functions, an organization can limit employee resistance.

Schedule Feasibility. Timeliness is important. **Schedule feasibility** requires the design team to estimate how long it will take a new or revised system to become operational and to communicate this information to the steering committee. For example, if a design team projects that it will take 16 months for a particular system design to become fully functional, the steering committee may reject the proposal in favor of a simpler alternative that the company can implement in a shorter time frame.

Legal Feasibility. Are there any conflicts between a newly proposed system and the organization's legal obligations? A new or revised system should comply with all applicable federal and state statutes about financial reporting requirements, as well as the company's contractual obligations.

> ***Case-in-Point 13.3*** Nevada is one of five states in the United States that does not have a state income tax. You would think, therefore, that any payroll system a Nevada company chose to implement would not need a module to withhold state income taxes from employee paychecks. But Reno, Nevada, is only ten miles from the California border, and California does have a state income tax. As a result, Reno employees who live in California must pay state income taxes even though they work in Nevada. So, companies in Reno, Nevada, must have state withholding modules in their payroll systems for employees who live in California.

Economic Feasibility. Through **economic feasibility** evaluation, the design team attempts to assess whether the anticipated benefits of the system exceed its projected costs. This requires accountants to perform a cost-benefit analysis. This analysis takes into account all costs, including indirect costs such as time spent by current employees on implementing the new system. It also considers benefits, which are sometimes difficult to foresee or

estimate. A mistake frequently made in thinking about new systems is underestimating costs for implementation and continuing operations. Accountants conducting the analysis need to separately identify one-time costs versus those that will be recurring. The point of the economic feasibility analysis is to get a ''best estimate'' of the worthiness of a project.

SYSTEMS DESIGN

Once the steering committee approves the feasibility of a general system plan (project), the design team can begin work on a **detailed systems design**. This involves specifying the outputs, processing procedures, and inputs for the new system. Just as construction blueprints create the detailed plans for building a house, the detailed design of a new system becomes the specifications for creating or acquiring a new information system. Figure 13-5 provides examples of the detailed requirements that the design team must create, and these requirements in turn explain specifically what the proposed system must produce.

From an accounting standpoint, one of the most important elements in a new system is its control requirements. In this matter, the design team should have a ''real-time'' mentality when designing control procedures for a system. In other words, rather than adding controls after a system has been developed and installed, the team should design cost-effective general and application control procedures into the system as integrated components. The Committee of Sponsoring Organizations (COSO) of the Treadway Commission (introduced in Chapter 8) emphasizes the importance of this view:

> *Whenever management considers changes to its company's operations or activities, the concept that it's better to "build-in" rather than "build-on" controls, and to do it right the first time, should be the fundamental guiding premise.*[3]

Requirements	Discussion
Processes	Descriptions of the various processes to be performed in the revised system, stressing what is to be done and by whom.
Data elements	Descriptions of the required data elements, including their name, size, format, source, and importance.
Data structure	Preliminary data structure that indicates how the data elements will be organized into logical records.
Inputs	Copies of system inputs and descriptions of their contents, sources, and who is responsible for them.
Outputs	Copies of system outputs and descriptions of their purpose, frequency, and distribution.
Documentation	Descriptions of how the revised system and each subsystem will operate.
Constraints	Descriptions of constraints such as staffing limitations and regulatory requirements.
Controls	Controls to reduce the risk of undetected errors and irregularities in the input, processing, and output stages of data processing work.
Reorganizations	Necessary changes such as increasing staff levels, adding new job functions, and terminating certain existing positions.

FIGURE 13-5 Examples of detailed requirements for a system proposal.

[3]Summarized from Committee of Sponsoring Organizations of the Treadway Commission (CSOTC), Internal Control-Integrated Framework (COSO Report), New York: 1992.

Designing System Outputs, Processes, and Inputs

Once the design team finds a system feasible and creates a general design, it can focus on developing the system's input, processing, and output requirements. When performing design tasks, it is perhaps curious that the design team first focuses on the outputs—not the inputs or processing requirements—of the new system. The reason for this is that the most important objective of an AIS is to satisfy users' needs. Preparing output specifications first lets these requirements dictate the inputs and processing tasks required to produce them.

During the analysis phase and general system design, the study team develops boundaries for the new system. These boundaries define the project's scope. However, as the design team works with users, they are likely to be asked to do additional work. Outside consultants often handle these requests by drafting proposals showing the additional costs associated with them. These costs can include delays in meeting the schedule for delivering the project.

> ***Case-in-Point 13.4*** Universities are large, complex organizations with many specialized processes. These entities are good candidates for enterprise systems, but **scope creep** and other problems can send these projects off track. To implement a Lawson Software system, the University of Wisconsin spent $25 million and six years, but they still were not ready for a system-wide rollout. One problem was customization, which required 251 programs and eight additional large applications to be added to the Lawson software. The North Dakota University System also had troubles as they worked to implement *PeopleSoft ERP*. The software project cost was $49 million ($14 million over budget) and over three years behind planned rollout. Extensive customized computing needs appear to be one source of the overruns for North Dakota's ERP.[4]

System Outputs. The design team will use the data gathered from the prior systems analysis work to help it decide what kinds of outputs are needed as well as the formats that these outputs should have. Although it is possible for the design team to merely copy the outputs of an older system, this would make little sense—the new system would be just like the old one. Instead, the team will attempt to create better outputs—that is, design outputs that will better satisfy their users' information needs than did the old system.

Outputs may be classified according to which functional area uses them (e.g., marketing, human resources, accounting, or manufacturing) as well as how frequently they must be produced (e.g., daily or weekly). Where a specific report is not needed on a regular basis, the system should be able to provide it when requested (a *demand report*) or triggered when a certain condition is met (an *exception report*). For example, an accounts receivable report on a specific customer's payment history might be issued on demand, or generated automatically when a customer owes more than a specified amount. Although many organizations still rely heavily on hard-copy (printed) reports, systems designers should also consider the possibility of creating soft-copy (screen) reports as an alternative.

Process Design. Until now, the system designers have focused on *what the system must provide* rather than *how the system can provide it*. After designing the outputs, their next step is to identify the processing procedures required to produce them. This involves deciding which application programs are necessary and what data processing tasks each program should perform.

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[4]Sources: Songini, Marc, ''Delays, Added Costs Threaten University's ERP Apps Rollout,'' *Computerworld* (August 1, 2005), pp. 1–2 and Songini, Marc, ''PeopleSoft Apps Vex N.D. Colleges,'' www.computerworld.com (June 23, 2006).

There are a large number of tools for modeling computer processes. Among them are the system flowcharts, data flow diagrams, program flowcharts, process maps, and decision tables discussed in Chapter 3. Another popular tool is the entity-relationship (E-R) diagram discussed in Chapter 4. Common to all these design methodologies is the idea of structured, top-down design, in which system designers begin at the highest level of abstraction and then ''drill down'' to lower, more detailed levels until the system is completely specified.

Designing System Inputs. Once the design team has specified the outputs and processing procedures for a new project, its members can think about what data the system must collect to satisfy these output and processing requirements. Thus, the team must identify and describe each data element in the systems design (e.g., ''alphabetic,'' ''maximum number of characters,'' and ''default value'') as well as specify the way data items must be coded. This is no easy task, because there are usually a large number of data items in even a small business application. Chapter 4 discusses the subject of data modeling in detail.

After the design team identifies and describes the input data, it can determine the source of each data element. For example, customer information such as name, address, and telephone numbers may be gathered directly from web screens, and the current date can be accessed from the computer system itself. Wherever possible, the design team will attempt to capture data in computer-readable formats, as noted in Chapter 2. This avoids costly, time-consuming data transcription as well as the errors such transcription typically introduce into the job stream.

Finally, system designers try to create systems that streamline data entry tasks because this facilitates the process and helps users avoid errors. Examples include substituting system default values, screen menus, and mouse clicks for system commands or other inputs that must otherwise be entered manually. Additional examples include using dialogue boxes for special user inputs and message boxes that help explain why a particular input value is unacceptable (Figure 13-6).

Prototyping

Prototyping means developing a simplified model of a proposed information system. A prototype is a scaled-down, experimental version of a nonexistent information system that a design team can develop cheaply and quickly for user-evaluation purposes. The prototype model does not run, but presents users with the ''look and feel'' of a completed system. By allowing users to experiment with the prototype, the designers can learn what users like and dislike in the mockup. They can then modify the system's design in response

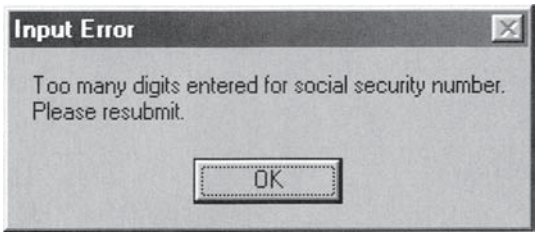

FIGURE 13-6 An AIS might display this error message if the user made a mistake entering a Social Security number in a dialogue box.

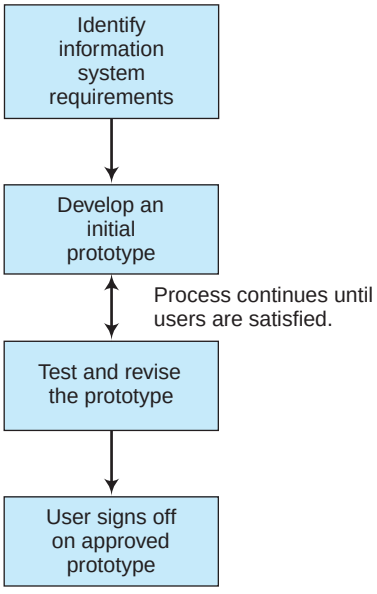

FIGURE 13-7 Steps in prototyping an accounting information system.

to this feedback. Thus, prototyping is an iterative process of trial-use-and-modification that continues until users are satisfied. Prototyping has four steps, as illustrated in Figure 13-7. The following case-in-point describes how it works in practice.

Case-in-Point 13.5 A company hired a consulting firm to develop a large-scale student management information system to manage its training and continuing education programs. The consulting firm developed a prototype that showed the primary input screens and reports. This prototype was used to obtain input to modify the inputs and outputs. For instance, users experimented with the screens, thinking about how easy it would be to input data through them. Users also considered whether the reports would give them the information they needed, such as a listing of all students in a class and all classes taken by a student. The programming to activate the screens and enable the processing, along with the database functionality, came later. This prototyping approach ensured that the completed system would satisfy user needs.

Prototyping has various advantages and disadvantages compared to the traditional design approach. In general, the procedure is useful when end users do not understand their informational needs very well, system requirements are hard to define, the new system is mission-critical or needed quickly, past interactions have resulted in misunderstandings between end users and designers, and/or there are high risks associated with developing and implementing the wrong system.

However, prototyping is not always the best systems design approach. For example, both managers and IT professionals can distrust it—the managers, if they perceive prototyping as ''too experimental'' and the IT professionals, if they harbor fears that the results lead to poor design solutions. Then, too, a design team can be misled if it relies on a small portion of the user population for developing its models and thus satisfies the informational needs of non-representative employees. For this reason, prototyping is not normally appropriate for designing large or complex information systems that serve many users with significantly different informational needs. Finally, IT professionals do not recommend prototyping for developing traditional AIS applications such as accounts receivable, accounts payable,

payroll, or inventory management, where the inputs, processing, and outputs are already well known and clearly defined.

The Systems Specifications Report

After the design team completes its work of specifying the inputs, outputs, and processing requirements of the new system, the members will summarize their findings in a (typically large) **systems specifications report**. Figure 13-8 provides some representative information that might be included in such a report. The design team submits this report to the steering committee for review, comment, and approval.

The Make or Buy Decision. The project is now at a critical juncture. If the steering committee approves the detailed design work, it now faces a make-or-buy decision. In large organizations, one possibility is to use internal IT staff to develop the project. This choice offers the tightest control over project development, the best security over sensitive data, the benefits of a custom product that has been tailor-made for the exact requirements of the application, the luxury of replacing the old system piecemeal as modules become available, and a vote of confidence for the organization's IT staff. But this choice also uses valuable

1. *Historical background information about the company's operating activities.* Included here would be facts about the types of products manufactured and sold by the company, the financial condition of the company, the company's current data processing methods, the peak volume of data processing activities, and the types of equipment currently being used in the company's data processing system.
2. *Detailed information about the problems in the company's current system.* By understanding the present systems problems, the computer vendors should have a better idea of what type of specific computer application will eliminate the company's system weaknesses. The design team may also include information about how soon they would like to receive the vendors' recommendations and the approximate date that the final decision will be made by their client regarding which computerized system will be purchased (or leased).
3. *Detailed descriptions of the systems design proposals.* For every design proposal, information should be included about such things as the data input and output of specific computer processing runs, the types of master files needed and the approximate volume of each file, the frequency of updating each master file, the format of each output report, the approximate length of each output report, the types of information included in each report and how often the various reports will be prepared, the organizational managers to whom every report will be distributed, and the company's available space for computer facilities.
4. *Indication of what the vendors should include in their proposals to the company.* This section of the systems specifications report, in effect, tells the vendors how detailed they should make their proposals. The company might request information regarding the speed and size of the central processing unit needed, the type of PCs needed for the company's local area network, the type and quantity of input and output devices as well as the capabilities of these devices, the availability of prewritten software packages for specific processing activities, the training sessions offered by the vendors on the operating details of the new system, the help provided by the vendors in implementing and testing the new system, the maintenance services available from the vendors, and the vendors' provisions for backup data processing facilities.
5. *Time schedule for implementing the new system.* This final section of the report will request the computer vendors to estimate the number of weeks, months, or years that will be necessary to implement their recommended computer systems within the company.

FIGURE 13-8 Systems specifications report information.

employee time and can divert the organization's resources from its main objectives—for example, manufacturing products.

Another possibility is to outsource the project's development to a contractor. This choice is useful when an organization lacks internal expertise to do the work or simply wishes to avoid the headaches of internal project development.

Finally, the steering committee can purchase prewritten software (commonly called **canned software**) and perhaps modify it to suit the firm's needs. If the organization requires both hardware and software, the committee may also choose to shop for a complete, ''ready-to-go'' **turnkey system**. The steering committee can ask the computer vendors to submit bid proposals for such a complete system, or alternatively, can ask each vendor to provide separate bids for hardware and software.

Choosing an Accounting Information System

Because internal project management and systems development are beyond the scope of this text, we'll assume here that the steering committee opts to acquire most of its system resources from outside vendors. This is the most common choice. If the committee takes this course of action, the systems specifications report helps them create a **request for proposal (RFP)** outlining the specific requirements of the desired system. Upon finalizing the system's specifications, the committee (with the help of the design team and perhaps outside consultants) will send a copy to appropriate vendors. Typically, the RFP also contains a deadline for bidding, the length of which varies—for example, just a few weeks for hardware, and longer periods of time for systems requiring custom development tasks.

After the deadline has passed, an evaluation committee supervised by the steering committee will review vendor submissions and schedule separate meetings with those vendors who provide viable system proposals. The participants at each meeting include representatives from the vendor, representatives from the steering committee, and representatives from the design team. The vendor's role is to present its proposal and to answer questions from the other participants. The evaluation committee's role is to listen to the vendor proposals, provide input to the steering committee about the pros and cons of each one, and perhaps make a recommendation for a preferred provider.

Selection Criteria. The steering committee's responsibility is to make a final selection and it is not restricted in its choices. It can accept one bid totally, negotiate with one vendor for specific resources, or spread its purchases among two or more providers. Here are some key factors that a steering committee should consider when evaluating vendor proposals:

- **The Performance Capability of Each Proposed System.** A vendor system must be able to process the organization's data so that management will receive outputs when they need them. There are many measures of performance, including speed, response time, number of users supported, and system testing. One way to examine the operating efficiency of a particular system is to use a **benchmark test**. With this approach, the vendor's system performs a data processing task that the new system must perform (e.g., payroll processing), and representatives of the organization then examine the outputs for accuracy, consistency, and efficiency.
- **Costs and Benefits of Each Proposed System.** The accountants on the design team will analyze the costs of every vendor's proposed system in relation to the system's anticipated performance benefits. They will also consider the differences between

purchasing and leasing each vendor's system. If the steering committee elects to purchase a system, the accountants should then advise the committee on a realistic depreciation schedule for the new system.

- **Maintainability of Each Proposed System.** This refers to the ease with which a proposed computer system can be modified. For example, this flexibility enables a firm to alter a portion of a payroll system to reflect new federal tax laws. Because the costs of maintaining a large information system are typically five times as much as the costs of initially acquiring or developing a system, the evaluators should place considerable emphasis on this dimension.
- **Compatibility of Each Proposed System with Existing Systems.** The new system must interface and work with existing computer hardware, software, and operating procedures. In some instances, this comes down to hardware issues. For example, it may not be possible to run specific software modules of the new system on some of the company's older local area network servers, which will consequently have to be upgraded. But compatibility issues can also involve the operating system, existing application software, or operational concerns as well—for instance, the requirement that employees learn a whole new set of procedures for inputting data.
- **Vendor Support.** Vendor support includes such things as (1) training classes that familiarize employees with the operating characteristics of the new system, (2) help in implementing and testing the new system, (3) assistance in maintaining the new system through a maintenance contract, (4) backup systems for temporarily processing company data if required, and (5) telephone assistance for answering user questions. The availability of ''business-hours-only'' versus ''round-the-clock'' support and the availability of domestic versus offshore customer support are other considerations. Most vendors charge extra for enhanced services.

Making a Final Decision. Because this book is about accounting information systems, our focus here will be on acquiring accounting software. Selecting an accounting system is a major responsibility that requires careful planning. After all, a software package that fails to meet the needs of a company or its accounting staff can throw an organization into turmoil, losing time and money. We discussed choosing software in some detail in Chapter 9. Here we discuss an analytical approach to choosing hardware and software vendors or AISs.

Point-Scoring Analysis. A technical approach for evaluating hardware or software that meets most of a company's major requirements is a **point-scoring analysis** such as the one illustrated in Figure 13-9. To illustrate, assume that in the process of selecting an accounts payable system, an organization finds three independent vendors whose packages appear to satisfy current needs. Figure 13-9 shows the results of the analysis. Because the cost to purchase or lease each vendor's accounts payable software package is about the same, ''cost'' is not an issue in this selection process.

When performing a point-scoring analysis, the evaluation committee first assigns potential points to each of the evaluation criteria based on its relative importance. For example, the committee feels that ''adequate controls'' (10 possible points) is more important than whether other users are satisfied with the software (8 possible points). After developing these selection criteria, the evaluation committee proceeds to rate each vendor or package, awarding points as it deems fit. The highest point total determines the winner. In Figure 13-9, the evaluation indicates that Vendor B's accounts payable software

Software Evaluation Criteria	Possible Points	Vendor A	Vendor B	Vendor C
Does the software meet all mandatory specifications?	10	7	9	6
Will program modifications, if any, be minimal to meet company needs?	10	8	9	7
Does the software contain adequate controls?	10	9	9	8
Is the performance (speed, accuracy, reliability, etc.) adequate?	10	7	8	6
Are other users satisfied with the software?	8	6	7	5
Is the software well documented?	10	8	8	7
Is the software compatible with existing company software?	10	7	9	8
Is the software user-friendly?	10	7	8	6
Can the software be demonstrated and test-driven?	9	8	8	7
Does the software have an adequate warranty?	8	6	7	6
Is the software flexible and easily maintained?	8	5	7	5
Is online inquiry of files and records possible?	10	8	9	7
Will the vendor keep the software up to date?	10	8	8	7
Totals	123	94	106	85

FIGURE 13-9 A point-scoring analysis for evaluating three independent vendors' accounts payable software packages.

package has the highest total score (106 points) and the committee should therefore acquire this vendor's system.

Although point-scoring analyses can provide an objective means of selecting a final system, many experts believe that evaluating accounting software is more art than science. There are no absolute rules in the selection process, only guidelines for matching user needs with software capabilities. Even for a small business, evaluators must consider such issues as the company's data processing needs, its in-house computer skills, vendor reputations, software costs, and so forth.

Selecting a Finalist. After each vendor presents its proposal to the organization, the steering committee must select the best one. Although a vendor's reputation is relative, a buyer can obtain clues by checking with the Better Business Bureau and speaking with some of the vendor's other clients. It is also possible that, say, because of the cost factor, none of the computer vendors' proposals is satisfactory. For example, perhaps at the time the design team performed their economic feasibility study, the results were favorable, but the subsequent detailed design specifications result in actual costs that are considerably higher than anticipated. At this point, the organization's steering committee can (1) request the design team to obtain additional systems proposals from other vendors, (2) abandon the project, or (3) outsource needed services.

Outsourcing

An alternative to developing and installing internal accounting information systems is to outsource them. As we discussed in Chapter 7, outsourcing occurs when a company hires an outside organization to handle all or part of the operations for a specific business function. Accounting tasks have long been a target for outsourcing, including accounts

payable, accounts receivable, payroll, general ledger, accounting for fixed assets, and financial reporting. Interestingly, U.S. tax returns are even being outsourced to workers in other countries, including India.

In the accounting area, the degree to which a company outsources its processing operations can range from routine assistance with a single application such as payroll or tax compliance to performing almost all the accounting functions of the organization. Outsourcing contracts are typically signed for five to ten years. Annual costs depend on the amount of data processing work to be performed and range from ''thousands'' to ''millions'' of dollars. When a large company decides to outsource its IT functions, it is not uncommon for the vendor to purchase all of its clients' hardware and software, and hire almost all of that company's IT employees. The outsourcing organization then operates and manages the client company's entire information systems, either on the client's site or by migrating the client's systems to its own computers.

Advantages and Disadvantages of Outsourcing. Often, making a decision to outsource a process is not an easy one. One advantage is that an organization can focus on its core competencies while ''experts'' do the other work. For example, hospitals often outsource their data processing functions so they can focus on better patient care. Outsourcing also frees managerial time, financial assets, and related resources for other purposes, and an organization doesn't need to worry about keeping up with technology in-house.

A primary motivator for outsourcing is cost savings. These come from economies of scale where the process-provider is able to spread costs among several clients and achieve high volumes for purchases. Another cost savings can come from moving selected operations to areas where real estate prices, building rents, or labor costs are less—for example, to offshore sites. This also enables a company to reduce its own labor force, save money, and remain competitive.

Although the advantages of outsourcing are compelling, outsourcing is not always the best alternative. One disadvantage is inflexibility. The typical outsourcing contract requires a company to commit to services for an extended time period—ten-year contracts are common. Should the contracting company become dissatisfied with the services it receives during this period of time, however, it is usually difficult to break the agreement. Even with a termination clause, the company may still be locked into outsourcing itself—for example, because it has already sold its data processing centers and terminated its IT staff.

Loss of control is another potential disadvantage. When an outsourcing vendor performs a significant portion of an organization's data processing, that organization loses control of its information systems. For example, the contracting company can no longer control its data, data errors, or other processing irregularities that occur from the outsourcer's processing work. Finally, outsourcing can cause an organization to lose competitive advantage. That is, when a company outsources its IT functions, it can also lose a basic understanding of its own information system needs or how its information systems could provide it with competitive advantages.

IMPLEMENTATION, FOLLOW-UP, AND MAINTENANCE

Systems implementation is often called the ''action phase'' of a systems study because the recommended changes from the prior analysis, design, and development work are now put into operation. But systems implementation can also be a stressful time. As the time draws

near for installing a new system, end users and clerical personnel become nervous about their jobs, middle managers wonder if the new system will deliver the benefits as promised, and top managers become impatient when installations run longer than anticipated or go over budget. Even if an organization did a perfect job of analyzing, designing, and developing a new system, the entire project can fail if its implementation is poor.

Implementation Activities

Implementing a new accounting information system involves many activities and tasks that will vary in number and complexity depending on the scale of the system and the development approach. Some of the steps that may be involved are:

1. **Prepare the Physical Site.** An organization must have physical space for any new hardware and personnel.
2. **Determine Functional Changes.** Whenever a company makes changes to a major accounting system, it must also consider the effects of such changes on its reporting structure and personnel relationships.
3. **Select and Assign Personnel.** Because the design team has developed detailed specifications for the new system, the organization should now have a firm idea about the job descriptions of system users.
4. **Train Personnel.** Both the implementation team and computer vendors can help train company employees to work with the new system, and seminars can acquaint other employees with the new system's advantages and capabilities. Vendors may provide technical training for free, or at reduced costs, to corporate users as incentives to use their products.
5. **Acquire and Install Computer Equipment.** After preparing the physical site for the new computer system, the company must acquire computer equipment such as PCs, web servers, routers, modems, and printers from outside vendors.
6. **Establish Internal Controls.** Chapters 11 and 12 described why an organization must install control procedures that safeguard its assets, ensure the accuracy and reliability of accounting data, promote operating efficiency, and encourage employee compliance with prescribed managerial policies. Again, these controls should be built into a system rather than added later.
7. **Convert Data Files.** When converting to a new system, an organization may have to convert its data files to alternate, more-useful formats. This activity is also common when merging two systems—for example, when consolidating formerly separate divisions of a company or merging the systems from two separate companies into one.
8. **Acquire Computer Software.** The implementation team must also install the software that was acquired or developed for the project. The software from independent vendors is often called canned software, which sometimes comes bundled (i.e., combined) with hardware in complete turnkey systems. In general, the process of acquiring (and possibly making modifications to) computer software from an independent vendor takes considerably less time than developing the programs in-house.
9. **Test Computer Software.** Programs must be tested regardless of where they came from to ensure day-to-day processing accuracy and completeness.
10. **Convert to the New System.** In switching to the new system, the firm may choose to make a **direct conversion** by immediately discontinuing use of the old system and

letting the new system ''sink or swim.'' An alternative is **parallel conversion**, where the organization operates both the new and the old system for some period of time. Another choice is **modular conversion**, where the new system is implemented in stages, one process or module at a time. An example would be first implementing the inventory module, then order processing, and so on.

The most difficult issue in implementing a new system is **change management**. The new system will bring with it changes to employee job descriptions and, in some cases, new jobs and no jobs. Members of the implementation team and steering committee should communicate openly with affected workers about how the new system will impact them. Organizations should give those employees whose jobs are either eliminated or materially altered an opportunity to apply for the new jobs and obtain retraining, if necessary. Similarly, terminated employees should receive ample notice to enable them to apply for other jobs before their employment ends. Some companies even set up internal outplacement offices for displaced employees or create early retirement plans for qualified employees.

Managing IT Implementation Projects

The preceding section made clear that there are many tasks involved in implementing a new accounting system. Moreover, an organization cannot perform these tasks randomly, but rather must complete them in a logical sequence. A good analogy is the process of building a house, which requires completing the foundation, sub-floors, and load-bearing walls before putting on the roof. Similarly, if an organization does not plan its systems implementation in an orderly fashion, the project's coordination is almost sure to suffer and its completion may be prolonged unreasonably.

There are many tools available to help manage projects. Two of these, **Program Evaluation and Review Technique** (PERT) and **Gantt charts**, help managers schedule and monitor the activities involved in large projects, such as implementation of a large-scale information system. There are also software solutions that may be used for project management, which we discuss below.

Program Evaluation and Review Technique. With PERT, a project leader first prepares a list of systems implementation activities, identifies the prerequisite activities that must be completed before others can start, and estimates the amount of time required to complete each activity. Figure 13-10 shows what a PERT diagram might look like for the implementation tasks outlined above. In the chart, Activity A might take 17 weeks and must be completed before Activity E. The activities A-E-H-I-J together, would take 55 weeks. The lines with arrows in this diagram conventionally flow from left to right and represent the activities required to implement the system. The circles (called *nodes*) in the diagram represent project milestones—i.e., the starting points or completions of specific activities—and therefore do not require any time.

Top managers may not be interested in PERT analyses, but they are usually very concerned about the time required to finish the entire project. The project leader can estimate this completion time by examining the various paths in the PERT network. Because PERT diagrams in actual practice are so large (often covering entire walls), project leaders normally use a computer to identify the longest paths through such networks. Within a PERT diagram, the longest path to project completion is called the **critical path**, which is also the shortest completion time of the entire project. The project leader will closely

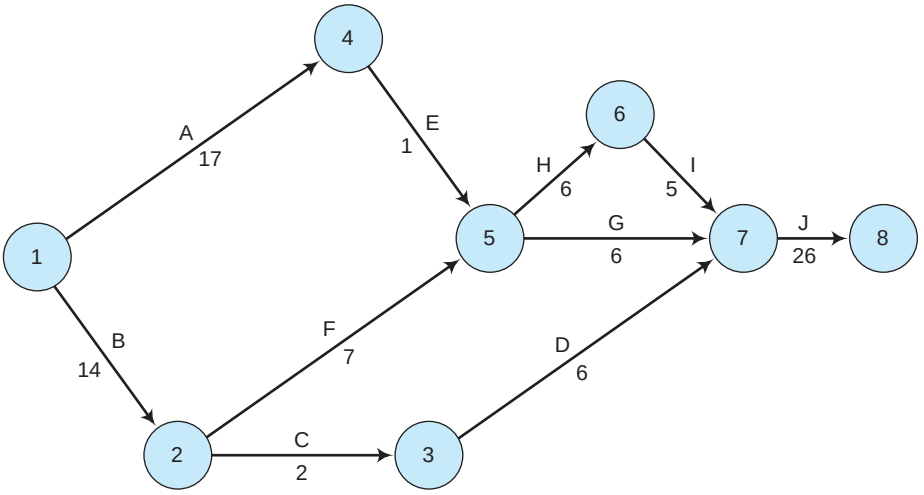

FIGURE 13-10 PERT network diagram for a systems implementation project.

monitor the work on each critical-path activity to avoid setbacks. **Slack time** describes the amount of delay time that can occur in each non-critical activity and still not delay the project. Slack time along the critical path is zero because delays in activities on this path automatically delay the entire project. PERT is a useful project management tool because of its ability to help managers identify critical paths and areas where slack time occurs.

As the implementation team performs specific activities, it also provides feedback reports to the steering committee that compare actual implementation times with planned times. These reports enable both parties to focus on delays in completing specific activities and to estimate what effect these delays may have on the entire installation project. If a specific critical activity is behind schedule, the project leader may allocate additional resources to speed its completion. Alternately, if another activity is ahead of schedule, the project leader may reduce the resources assigned to it and use them elsewhere.

Gantt Charts. Another tool that an organization can use in planning and controlling a systems implementation project is a **Gantt chart** (Figure 13-11). Gantt charts are useful for both scheduling and tracking the activities of systems implementation projects because actual progress can be indicated directly on the Gantt chart and contrasted with the planned progress.

Gantt charts are straightforward, easy to understand, and can be used with PERT to compare estimated completion times against actual ones. A disadvantage of Gantt charts is that they do not indicate the precedence of activities for the project, as do PERT charts. Rather, a Gantt chart treats each activity as if it were independent of the others, which of course is not really the case. For this reason, Gantt charts are better suited for systems implementation projects that are not complex and have relatively few interrelationships among implementation activities.

Project Management Software. As noted above, PERT diagrams can become complex, making the calculations required to compute and re-compute critical paths and slack times difficult. **Project management software** that runs on desktop or notebook computers can perform these tasks easily and quickly, can enable a project leader to plan and

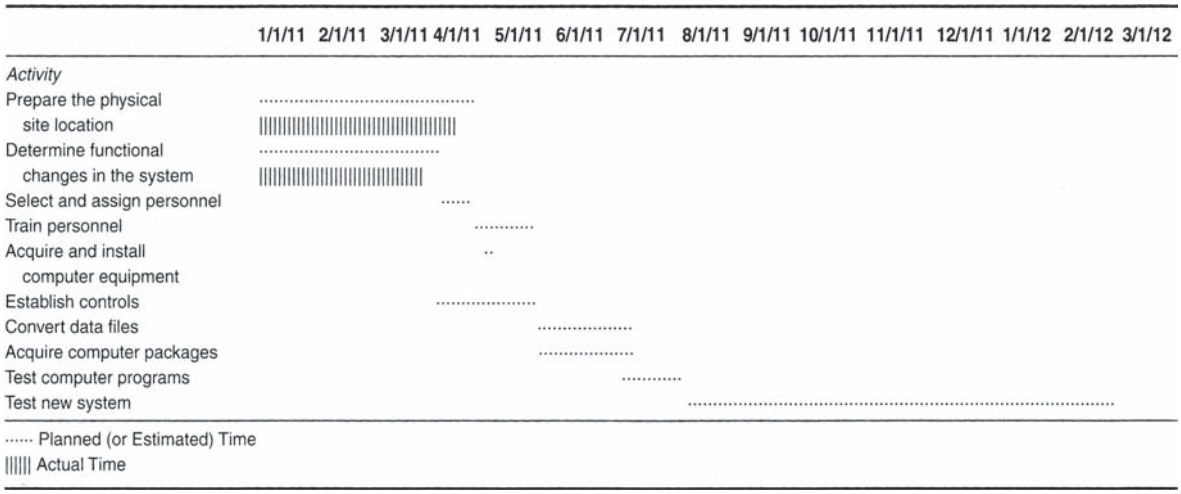

FIGURE 13-11 Gantt chart for systems implementation activities.

control implementation tasks, and can help a team install a new system on time and within budget. Examples of project management software solutions include *eProject, Microsoft Project, PlanBee*, and *Time Line*.

Project management software requires users to break down complex projects into smaller, simpler activities and to estimate the time, cost, and other resources required for each of them. The project leader then enters these estimates into the computer running the project software, along with the priority of the various activities of the project. The software can then schedule tasks, identify critical and non-critical activities, compute slack times, and so forth. Project management software also allows the project leader to perform what-if analyses—for example, to experiment with different systems implementation work schedules or determine how delays in specific activities are likely to affect other project tasks.

Interestingly, some of the more current project management information systems are much more complex than some of the earlier software solutions. These new systems are not limited to just scheduling and resource management—they are now much more comprehensive and can support the entire life-cycle of projects.[5]

Post-Implementation Review

Regardless of which conversion method used, the new system will eventually become the sole system in operation. This brings us to the final, **follow-up and maintenance phase** of our systems development life cycle. The purpose of this phase is to monitor the new system and make sure that it continues to satisfy the three levels of organizational goals discussed at the beginning of this chapter: (1) general systems goals, (2) top management systems goals, and (3) operating management systems goals. When these goals are not adequately satisfied, problems normally occur and the system requires further modifications.

[5]Source: F. Ahlemann, "Towards a conceptual reference model for project management information systems," *International Journal of Project Management* (January 2009), pp. 19–30.

After the new system has been in operation for a period of time, the implementation team should reevaluate the new system's effectiveness by:

- Talking with top management personnel and operating management personnel about their satisfaction with the new system.
- Talking with end users to determine their satisfaction.
- Evaluating the control procedures of the system to verify whether they are functioning properly.
- Observing employee work performance to determine whether they are able to perform their job functions efficiently and effectively.
- Evaluating whether computer processing functions, including data capture and preparation, are performed efficiently and effectively.
- Determining whether output schedules for both internal and external reports are met with the new computer system.

At the conclusion of the initial follow-up study, the team prepares a report called a *post-implementation review report* for the steering committee that summarizes the implementation team's findings. If the implementation team is satisfied that the new system is working satisfactorily, no further revisions are required. If follow-up studies reveal that problems still exist in the new system, the team will communicate these findings to the steering committee and perhaps recommend further systems studies. Upon receiving approval from the steering committee, the organization will then perform the systems study steps again with the objective of making revisions to the system.

A post-implementation review is also beneficial to the implementation team. At this point in the systems development life cycle, the team members are now in a position to evaluate their own work, learn from the mistakes they made or successfully avoided, and become more skilled ''systems people'' in future engagements.

System Maintenance

In practice, implementation teams do not normally perform follow-up studies of their company's new information system. Instead, the team turns over control of the system to the company's IT function, which now shoulders the responsibility for maintaining it. In effect, **system maintenance** continues the tasks created by the initial follow-up study, except that experts from the company's IT subsystem now perform the modifications exclusively. For example, when users complain about errors or anomalies in the new system, it becomes the IT subsystem's responsibility to respond to these needs, estimate the cost of fixing them, and (often) perform the necessary modifications. The IT departments of even medium-size companies typically have forms for such requests, policies for prioritizing maintenance tasks, and formulas for allocating maintenance costs among the various user departments.

It is common for business systems to require continuous revisions. Some of the common reasons include: increased competition, new governmental regulations, or the information needs of top management (or other levels of management) change. In fact, studies show that, over the life of a typical information system, organizations spend only about 20–30% of the total system costs developing and implementing it. They spend the remaining 70–80% maintaining it, typically on further modifications or software updates. In other words, ''maintenance'' may not be the most glamorous part of a systems development life cycle,

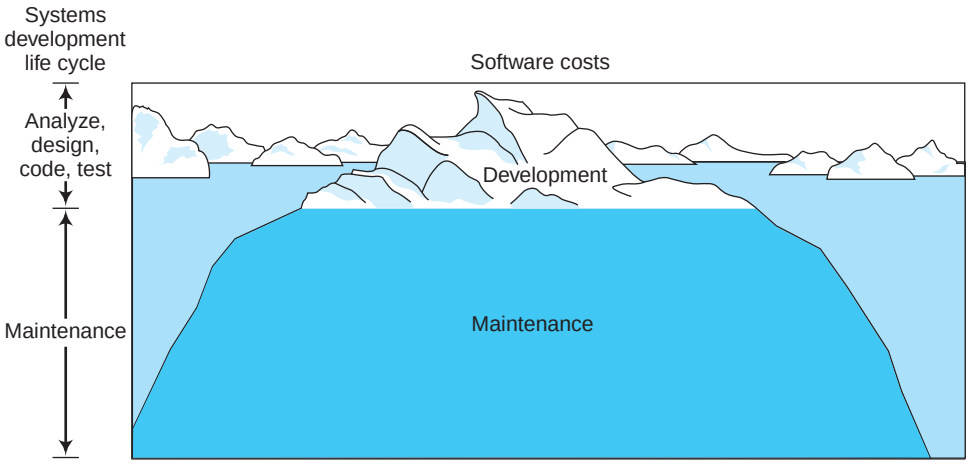

FIGURE 13-12 In the systems development life cycle, the costs of analysis, design, development, and implementation are often just the tip of the iceberg: software maintenance costs are the most expensive part.

but it is almost always the most expensive part. For this reason, organizations try to develop or acquire *flexible systems*—that is, systems that are easily modified—because such systems save businesses money in the long run (even if they cost more in the short run).

AIS AT WORK
Outsourcing and Offshoring IT

A recent research survey of 420 IT professionals found cost savings to be the primary reason companies choose to outsource their IT. Some cost savings stem from increased business flexibility, and some from avoiding personnel costs (i.e., health care, pensions, and other benefits). Companies that use outsourced IT services have the ability to be more flexible and can adapt quickly to ebbs and flows in business and demands for IT services. Cost savings for labor is achieved by sending IT work to countries with lower wages. One quarter of all outsourced IT dollars is spent on offshore IT, with much of that work going to service providers in India.

In evaluating IT service providers domestically, ''reliability'' is the most important criterion. Domestic US companies including IBM and Accenture are benefiting from the trend to increased outsourcing of IT services.

When choosing an offshore vendor, it's all about cost. Indian companies, such as Satyam Computer Services, Tat Consulting Services (TCS), and Cognizant Technology Solutions (CTS) are often selected for IT services.

CTS will soon reach the $1 billion revenue mark. Its fast growth may be partly due to its ''Americanism.'' CTS is not purely an American company, nor is it Indian. It's a hybrid company that may be considered either American-Indian, or Indian-American. The CEO resides in the company's New Jersey headquarters and the company uses an American approach to developing customers in that it develops strategic solutions. CTS emphasizes specialization in business applications, primarily in the financial services and health care industries.

CTS, one of the NASDAQ 100, demonstrates the complex relationships that are becoming more common in global business. The company was founded to take advantage of India's labor pool and low labor costs. Just as US companies once moved among states, now it is the case that American, Indian, Chinese, and European companies look at earth's whole map—and they do the work where it can be done best and/or costs the least.[6]

SUMMARY

- The four stages in a systems development life cycle are: (1) planning and investigating, (2) analysis, (3) design, and (4) implementing, follow-up, and maintenance.
- Planning requires creating a team to investigate the current system and make recommendations to a steering committee.
- Systems analysis requires identifying general systems goals, top management systems goals, and operating management systems goals.
- A systems survey uses a variety of data gathering techniques to understand and document the system.
- The systems analysis report contains the study team recommendations.
- The components of a feasibility evaluation are technical, operational, legal, and economic feasibility.
- Detailed systems design begins with the design of outputs, and then inputs and processes. Designers may choose a prototyping approach to create the new system.
- A systems specifications report contains detailed information about the organization and its desired system.
- Choosing a system requires evaluating system performance capabilities, costs and benefits, system maintainability, system compatibility with other systems, and vendor support.
- An organization may choose to outsource its IT operations or accounting processes.
- Organizations use PERT, Gantt charts, and project management software to manage the implementation of information systems.
- Organizations need to follow-up to find out if new systems are working as planned.

KEY TERMS YOU SHOULD KNOW

applications portfolio
benchmark test
canned software
change management
critical path
detailed systems design
direct conversion
economic feasibility
feasibility evaluation
follow-up and maintenance phase
Gantt chart
legal feasibility
modular conversion
operational feasibility
parallel conversion
PERT
point-scoring analysis
preliminary investigation
project management software
prototyping

[6]Sources: Paul McDougall. "Cost Conscious, But Demanding," *InformationWeek*, June 19, 2006, pp. 43–48, and Nitya Varadarajan. "Its New Billion Dollar Baby; Cognizant Technology Solutions, Soon to Reach $1 Billion in Revenues Will Be the Youngest Company to Enter Indian IT's Exclusive Club. What Is Its Secret?" *Business Today*, New Delhi, India, February 10, 2006, p. 70.

request for proposal (RFP)
schedule feasibility
scope creep
slack time
steering committee
system development life cycle (SDLC)
system maintenance
systems analysis
systems approach
systems implementation
systems specifications report
systems study
systems survey
technical feasibility
turnkey system

TEST YOURSELF

Q13-1. Which of the following statements is NOT true:

a. A preliminary investigation of a current system is conducted by the steering committee

b. Implementation, follow-up, and maintenance of IT includes acquiring resources for the new system

c. In designing an AIS, the design team will begin with outputs

d. The more work done during planning and analysis, the less likely the new system will fail

Q13-2. The feasibility evaluation:

a. Is completed prior to detailed systems design

b. Includes economic, schedule, technical, legal, and operational feasibility

c. Both a and b are true

d. Neither a nor b is true

Q13-3. In developing and implementing IT, the study team and steering committee must consider organizational goals. These include:

a. General, technical, and top management goals

b. General, operating management, and technical goals

c. Top management, operating management, and economic goals

d. Top management, operating management, and general systems goals

Q13-4. Prototyping, as an IT development approach, has both advantages and disadvantages. In general, prototyping is most appropriate when:

a. The design team is not pressed for time in creating a new system

b. Users have a thorough understanding of their information needs

c. There are high risks associated with developing and implementing an ineffective system

d. System requirements are easily defined

Q13-5. In selecting a new accounting information system, the steering committee should consider:

a. All expected costs and benefits of the new systems, including maintenance and operating costs

b. Support that a vendor can provide, including training, maintenance, and backup

c. Compatibility of a new system with existing systems

d. All of the above are considerations in selecting a new system

e. Only a and b are important considerations in selecting the new system

Q13-6. A point-scoring analysis:

a. Is a useful tool in conducting a feasibility analysis

b. Helps the systems study team to decide whether or not to outsource their AIS

c. Provides a systems study team with an objective means for selecting a final AIS

d. Is a tool used for managing IT projects

Q13-7. Which of the following statements is NOT true with respect to managing IT projects:

a. Program evaluation and review technique (PERT) allows management to determine the shortest time it will take to implement a new system, and any slack time that might exist between implementation activities

b. An advantage of PERT is that it allows managers to identify the critical path in implementation

c. Both PERT and Gantt charts are manual techniques used in managing IT implementations

d. Gantt charts are useful in scheduling and implementing IT because they allow you to indicate actual progress versus planned progress directly on the chart

Q13-8. When converting to a new system, which of the following conversion alternatives would be the most risky for a financial services firm?

a. Direct conversion

b. Modular conversion

c. Parallel conversion

d. Turnkey conversion

Q13-9. Which one of the four stages in the Systems Development Life Cycle is likely to be the most costly for a new system?

a. Planning and Investigation

b. Analysis

c. Design

d. Implementation, Follow-up, & Maintenance

DISCUSSION QUESTIONS

13-1. Discuss the major differences between the planning, analysis, and design phases of a systems study.

13-2. What is a steering committee? Discuss its role in a systems study performed by a consulting firm.

13-3. A systems study team should understand three levels of corporate goals: general systems goals, top management systems goals, and operating management systems goals. If you had to select one of these categories of systems goals as the most important to the effective operation of an organization's information system, which one would you choose? Explain the reasons for your choice.

13-4. What is the purpose of a systems feasibility evaluation? Should this activity precede or follow the preparation of a systems specifications report for computer vendor evaluation? Explain.

13-5. Discuss some of the annual cash benefits and annual cash costs that a company might have when it creates an online ordering system on the World Wide Web.

13-6. What is prototyping? Under what circumstances should prototyping be used? Under what circumstances should it not be used?

13-7. What is the purpose of a systems specifications report? In what ways, if any, do the data included in this report differ from the data accumulated by the design team during their feasibility evaluation work?

13-8. When implementing a new computer system, two activities required are (1) establish controls and (2) convert data files. What is the rationale for performing activity 1 before activity 2?

13-9. Three methods for implementing a new system in an organization are direct conversion, parallel conversion, and modular conversion. Discuss the advantages and disadvantages of using each of these three systems implementation methods.

13-10. What is a PERT chart? What is a Gantt chart? Discuss the advantages and disadvantages of using PERT network diagrams versus Gantt charts for planning and controlling the activities involved in implementing an information system.

13-11. What is the purpose of follow-up in a systems study? Describe some of the specific activities that the management implementation team would perform in their follow-up work.

13-12. Discuss the two major ways that a company's software can be acquired. Which of these ways for acquiring software do you recommend? Explain your reasoning.

13-13. What is business process outsourcing and why do firms outsource their IT functions?

PROBLEMS

13-14. The Valaria V Company manufactures and distributes low-priced bottled wines to retailers. You are hired as a management consultant to help this company solve some of its systems problems. Describe the types of decision-making information that probably would be needed by the company's (a) supervisor of the production plant, (b) top management, and (c) marketing manager.

13-15. Stevenson Apparel is a manufacturer of fashion clothing that has just opened its first large retail store for selling in-season clothes at regular prices. The company's competitive strategy depends on a comprehensive point-of-sale (POS) system supporting online, up-to-the-minute sales totals, day-to-day tracking of stock information, and quick checkout of customer purchases. Because cashiers were already familiar with electronic cash registers, management decided that only minimal training was required. Cashiers enter four-digit stock tracking numbers (STNs) into one of the POS terminals that retrieves price and description data, computes the tax and total amount due, accepts the type of payment, and controls the cash drawer. A unique STN identifies each of the 9,500 pieces of merchandise. The central computer server maintains stock information.

In the first month of operation, new cashiers were awkward using the new system. They eventually became proficient users but were frustrated with the slow printing of sales tickets and the unpredictable action of their cash drawers. Each checkout stand has a telephone that cashiers use to call for approval of credit-card transactions. Customers became impatient when credit approvals delayed the checkout process or when the computer was down, thus stopping all sales, including cash sales. Identify four problems with the system and describe how you would remedy each of them.

13-16. Jay Beck works for the NSR Consulting Firm. His friend, Hank Henley, is the general manager and majority stockholder of the Pacific Worldwinds, a professional football team. Hank asked Jay to design an online, real-time computer system for ''the efficient operation of the football franchise.'' Jay was quite confused because he could not think of any possible uses for an online, real-time system within the operational activities of a football team (or any other type of athletic team). Assume that you are also employed at the consulting firm. Provide several suggestions to Jay concerning specific areas of athletic teams' (football teams, baseball teams, etc.) information systems where an online, real-time computer configuration might be beneficial to managerial decision making.

13-17. Cook Consultants is currently in the process of completing the systems implementation activities for converting The Samuel Company's old system to a new one. Because of unexpected delays in performing specific implementation activities, Jerry Hazen, the project manager, is concerned about finishing the project on time. The one remaining activity is testing the new computer system and subsequently eliminating the old one. Jerry's assistant, Jan Kramer, suggests that they can still meet their completion deadline if they use ''direct conversion'' rather than ''parallel conversion.'' Assuming that you are the CIO of the company, how would you react to Jan's suggestion? Discuss.

13-18. With the help of your instructor, identify a particular information system that is not working very well and perform a preliminary investigation of it. In your work, be sure to talk to (1) at least one external ''customer'' who is affected by the system, (2) one employee who uses the system daily, and (3) one person who manages this type of employee. For example, at a university, you might study the student parking information system. The ''customers'' are those car owners who purchase parking permits (e.g., students, faculty, and university staff members), data input clerks are the employees who use the system daily, and the parking manager is the person who supervises these employees. Ask each such person what he or she feels are the problems of the system, and what they think should be done to address these problems.

Prepare a preliminary investigation report that describes your system and outlines the following items: (a) the problems that each person experiences with the system, (b) the actions that each person thinks might solve the problems, and (c) your opinion of which difficulties are the ''real problems'' and which are just symptoms of these problems. Also include some recommendations. Should the present system be replaced, are minor modifications required, or is the system mostly acceptable as it is?

CASE ANALYSES

13-19. Wright Company (Analyzing System Reports)

Wright Company employs a computer-based data processing system for maintaining all company records. The current system was developed in stages over the past five years and has been fully operational for the last 24 months.

When the system was being designed, all department heads were asked to specify the types of information and reports they would need for planning and controlling operations. The systems department attempted to meet the specifications of each department head. Company management specified that certain other reports be prepared for department heads. During the five years of systems development and operation, there have been several changes in the department head positions due to attrition and promotions. The new department heads often made requests for additional reports according to their specifications. The systems department complied with all of these requests. Reports were discontinued only on request by a department head, and then only if it was not a standard report required by top management.

As a result, few reports were discontinued. Consequently, the information processing subsystem was generating a large quantity of reports each reporting period. Company management became concerned about the quantity of report information that was being produced by the system. The internal audit department was asked to evaluate the effectiveness of the reports generated by the system. The audit staff determined early in the study that more information was being generated by the information processing subsystem than could be used effectively. They noted the following reactions to this information overload:

- Many department heads would not act on certain reports during periods of peak activity. The department heads would let these reports accumulate with the hope of catching up during subsequent lulls.
- Some department heads had so many reports they did not act at all on the information, or they made incorrect decisions because of misuse of the information.

- Frequently, actions required by the nature of the report data were not taken until the department heads were reminded by others who needed the decisions. These department heads did not appear to have developed a priority system for acting on the information produced by the information processing subsystem.
- Department heads often would develop the information they needed from alternative, independent sources, rather than use the reports generated by the information processing subsystem. This was often easier than trying to search among the reports for the needed data.

Requirements:

1. Indicate whether each of the foregoing four reactions contributes positively or negatively to the Wright Company's operating effectiveness. Explain your answer for each of the four reactions.
2. For each reaction that you indicated as negative, recommend alternative procedures the Wright Company could employ to eliminate this negative contribution to operating effectiveness.

(CMA adapted)

13-20. Kenbart Company (Redesigning Profit Plan Report)

The managers at Kenbart Company have decided that increased emphasis must be placed on profit planning and comparing ''results'' to ''plans.'' A new profit planning system has been implemented to help with this objective. The company uses contribution margin reporting for internal reporting purposes and applies the concept of flexible budgeting for estimating variable costs. Kenbart's executive management uses the following terms when reviewing and analyzing actual results and the profit plan.

- **Original Plan:** profit plan approved and adopted by management for the year
- **Revised Plan:** original plan modified as a consequence of action taken during the year (usually quarterly) by executive management
- **Flexed Revised Plan:** the most current plan (i.e., either original plan or revised plan, if one has been prepared) adjusted for changes in volume and variable expense rates
- **YTD Actual Results:** the actual results of operations for the year
- **Current Outlook:** the summation of the actual year-to-date results of operations plus the flexed revised plan for the remaining months of the year

Executive management meets monthly to review the actual results compared with the profit plan. Any assumptions or major changes in the profit plan usually are incorporated on a quarterly basis once the first quarter is completed. Figure 13-13 provides an outline of the basic Profit Plan Report designed by the information processing subsystem. The current system produces this report at the end of the month and whenever executive management initiates a change or modification in its plans. Consequently, many different versions of the firm's profit plan exist, which makes analysis difficult and confusing.

Several members of executive management have voiced disapproval of the Profit Plan Report because the ''Plan'' column is not well defined and varies in meaning from one report to another. Furthermore, the report does not include a current-outlook column.

Kenbert Company Profit Plan Report
Month, Year-to-Date

	Month				Year-to-Date			
			Over/ (Under)				Over/ (Under)	
	Actual	Plan	$	%	Actual	Plan	$	%
Sales								
Variable manufacturing costs								
Raw materials								
Direct labor								
Variable overhead								
Total variable manufacturing costs								
Manufacturing margin								
Variable selling expenses								
Contribution margin								
Fixed costs								
Manufacturing								
Sales								
General administration								
Income before taxes								
Income taxes								
Net income								

FIGURE 13-13 Basic profit plan report outline.

Therefore, the accounting subsystem has been asked to work with the information processing subsystem in modifying the report so that users can better understand the information being conveyed and the reference points for comparison of results.

Requirements:

1. Redesign the layout of the Profit Plan Report so that it will be more useful to Kenbart's executive management in its task of reviewing results and planning operations.
2. Explain the reason for each modification you make in the report.

13-21. Stephen Kerr Cosmetics (Point-Scoring Analysis)

Kerr Cosmetics distributes cosmetic products to large retailers across the country. The firm was started in 1975 by its first president, Stephen Kerr, who still serves as chairman of the board. Over the years, the company has grown in size and complexity. As the company has prospered, Richard Mason, the controller, has acquired and installed new accounting software to accommodate the increasing demands on the firm's accounting systems.

This year, Richard has convinced Stephen that it is time to upgrade their payroll system, which is now 7 years old. The company hires an outside consultant, who examines their situation and concludes that either one of two systems can meet their requirements. Richard therefore asks two of his most competent employees, Fritz Bauman and Meg Chrisman, to help him perform a point-scoring analysis and make a final choice.

The three individuals meet as a study team and agree upon five qualities for rating the two vendors: (1) need for further modifications, (2) ease of use, (3) strength of internal controls, (4) flexibility for updating and Internet options, and (5) vendor support. To help them rate the two vendors on these five criteria, the committee invites representatives from each vendor to visit the company and make a presentation. Fritz makes arrangements for the presentation team from Vendor A to present on a Friday morning, and a similar team from Vendor B to visit that same afternoon. Unfortunately, an emergency makes it impossible for Richard to attend either presentation. Meg and Fritz attend both sessions, but come away with very different impressions of the competing software. The table below provides some relevant data.

Requirements:

1. To start their analysis, Meg and Fritz decide to use their own ratings to perform separate point scoring analyses. For this part, use equal weightings of 0.2 for each category. Perform similar analyses using a spreadsheet. Which vendor does each person prefer?
2. Both Meg and Fritz decide that using equal weight for each category doesn't make sense. After some discussion, they agree to the ''compromise weights'' shown below. They again perform their analyses. Which vendor does each person prefer now?
3. Fritz and Meg show their results to Richard, who suggests that they use their compromise weights but use combined averages for their grades for each vendor. They perform yet a third analysis. Which vendor receives the highest total now?
4. What do these exercises suggest about point scoring analyses? Does this method still seem ''objective'' to you? Why or why not?

			Fritz's Weights		Meg's Weights	
	Equal Weights	Compromise Weights	Vendor A	Vendor B	Vendor A	Vendor B
Required Modifications	0.2	0.2	3	2	3	3
Ease of Use	0.2	0.3	8	3	4	6
Internal Controls	0.2	0.1	3	4	2	4
Flexibility	0.2	0.1	4	5	3	7
Vendor Support	0.2	0.3	7	5	3	9

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ANSWERS TO TEST YOURSELF

1. **b** 2. **c** 3. **d** 4. **c** 5. **d** 6. **c** 7. **c** 8. **a** 9. **d**