Part IV

Systems Development Activities

CHAPTER 13

Managing the Systems Development Life Cycle

CHAPTER 14

Construct, Deliver, and Maintain Systems Project

Chapter 13

Managing the Systems Development Life Cycle*

LEARNING OBJECTIVES

After studying this chapter, you should:

- Be able to identify the key stages in the SDLC.
- Recognize how a firm's business strategy will shape its information system.
- Understand the relationship between strategic systems planning and legacy systems.
- Understand what transpires during systems analysis.
- Understand the TELOS model for assessing project feasibility.
- Be familiar with cost-benefit analysis issues related to information systems projects.
- Understand the role of accountants in the SDLC.

A responsive, user-oriented information system is a valuable asset of the modern business organization. Well-designed systems can increase business performance by reducing inventories, eliminating nonvalue-added activities, improving customer service, and coordinating supply chain activities.

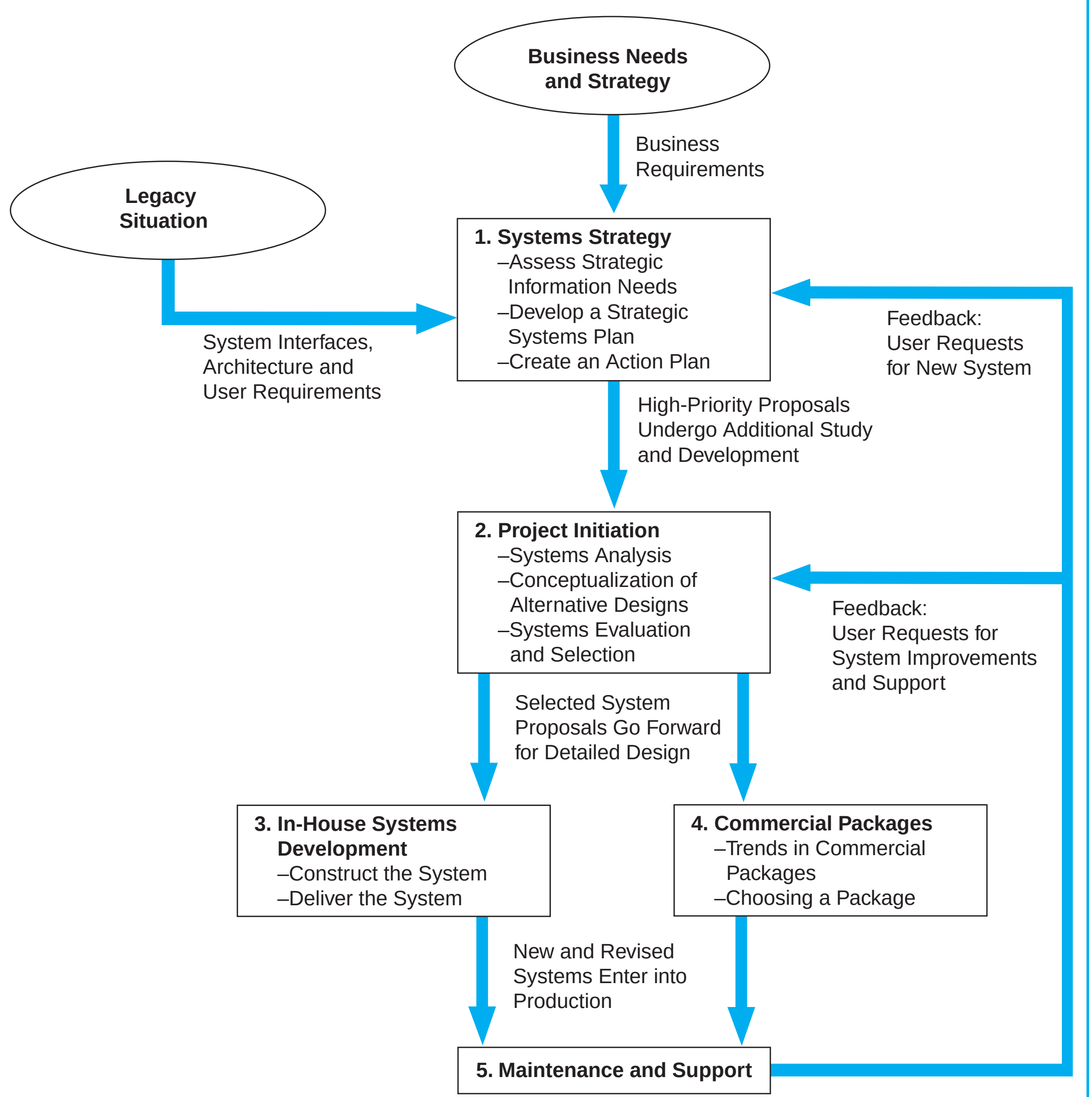
This chapter examines several topics related to the process by which organizations acquire information systems. It begins with an overview of the systems development life cycle (SDLC). This multistage process guides organization management through the development and/or purchase of information systems. Next, the chapter presents the key issues pertaining to developing a systems strategy, including its relationship to the strategic business plan, the current legacy situation, and feedback from the user community. The chapter provides a methodology for assessing the feasibility of proposed projects and for selecting individual projects to go forward for construction and delivery to their users. The chapter concludes by reviewing the role of accountants in managing the SDLC.

* This chapter was co-authored by Jiri Polak, PhD, Deloitte & Touche, and Vojtech Merunka, PhD, Deloitte & Touche.

The Systems Development Life Cycle

Moderate and large firms with unique information needs often develop information systems in-house. That is to say that IT professionals within the firm design and program the systems. A greater number of smaller companies and large firms with relatively standardized information needs opt to purchase information systems from software vendors. Both approaches represent significant financial and operational risks. The **SDLC** shown in Figure 13-1 is a model for reducing this risk through careful planning, execution, control, and documentation of key activities. The five phases of this model are outlined below. Systems strategy and project initiation are discussed in this chapter. The remaining phases are the topics of Chapter 14.

FIGURE 13-1 Systems Development Life Cycle



Systems Strategy. The first step in the SDLC is to develop a systems strategy, which requires understanding the strategic business needs of the organization. This may be derived from the organization's mission statement, an analysis of competitive pressures on the firm, and the nature of current and anticipated market conditions. These needs reflect the organization's current position relative to where it needs to be in the long term to maintain strategic advantage. In addition, project management must consider the information systems' implications pertaining to legacy systems and concerns registered through user feedback. A strategic plan for meeting these various and complex needs, along with a timetable for implementation of selected systems, is produced.

Project Initiation. Project initiation is the process by which systems proposals are assessed for consistency with the strategic systems plan and evaluated in terms of their feasibility and cost-benefit characteristics. Alternative conceptual designs are considered, and those selected enter the construct phase of the SDLC. Depending upon the nature of the project and the needs of the organization, the proposal will require in-house development, a commercial package, or both.

In-House Development. As mentioned earlier, some organizations have unique information needs that can be adequately met only through internal development. The in-house development step includes analyzing user needs, designing processes and databases, creating user views, programming the applications, and testing and implementing the completed system.

Commercial Packages. When the nature of the project and the needs of the user permit, most organizations will seek a precoded commercial software package rather than develop a new system from scratch. The organizations that can implement commercial software accrue a number of advantages. These include lower initial cost, shorter implementation time, better controls, and rigorous vendor testing. All of these benefits translate into cost savings for the user. This process, however, is not without risk. Formal procedures need to be followed to ensure that the user gets a package that adequately meets his or her needs and is compatible with existing systems.

Maintenance and Support. Maintenance involves both acquiring and implementing the latest software versions of commercial packages and making in-house modifications to existing systems to accommodate changing user needs. Maintenance may be relatively trivial, such as modifying an application to produce a new report, or more extensive, such as programming new functionality into a system. The feedback loops from maintenance to the project initiation and systems strategy steps, respectively, despite these relationships.

Traditionally, systems maintenance was viewed as a separate and distinct stage of the SDLC that could last 5 to 10 years. Modern businesses in highly competitive industries, however, see frequent changes in technology and much shorter system life spans. Indeed, this is becoming the norm for many organizations. Many complex systems today are developed and implemented using an incremental approach that integrates maintenance and new development. System maintenance is often viewed as the first phase of a new development cycle. Existing (maintained) applications are the prototypes for their new versions. Thus, instead of implementing an application in a single big bang release, modern systems are delivered in parts continuously and quickly as smaller releases that can more accurately reflect changing business needs. Another aspect of modern maintenance includes establishing a user support infrastructure. This could include helpdesk services, providing user training and education classes, and documenting user feedback pertaining to problems and system errors.

Participants in Systems Development

The participants in systems development can be classified into three broad groups: systems professionals, end users, and stakeholders.

Systems professionals are systems analysts, systems designers, and programmers. These individuals actually build the system. They gather facts about problems with the current system, analyze these facts, and formulate a solution to solve the problems. The product of their efforts is a new system.

End users are those for whom the system is built. Many users exist at all levels in an organization. These include managers, operations personnel, accountants, and internal auditors. In some organizations, it is difficult to find someone who is not a user. During systems development, systems professionals work with the primary users to obtain an understanding of the users' problems and a clear statement of their needs.

As defined in Chapter 1, **stakeholders** are individuals either within or outside the organization who have an interest in the system but are not end users. These include accountants, internal auditors, external auditors, and the internal steering committee that oversees systems development.[1]

Systems Strategy

The objective of **systems strategy** is to link individual system projects to the strategic objectives of the firm. Firms that take systems strategy seriously establish a steering committee to provide guidance and oversight for systems projects. The composition of the **steering committee** may include the chief executive officer, the chief financial officer, the chief information officer, senior management from user areas, the internal auditor, and senior management from computer services. External parties, such as management consultants and the firm's external auditors, may also supplement the committee. This committee is involved not only in developing system strategy but in every major phase of the SDLC.

The strategy stage in the SDLC consists of three fundamental tasks: assessing the organization's strategic information needs, developing a strategic systems plan, and creating actions plans. The inputs to the systems strategy phase are the business plan, the legacy system situation, and feedback from the user community. In this section we see how these pieces come together to form a comprehensive strategic plan that will generate action plans for selecting and developing individual systems projects.

Assess Strategic Information Needs

Strategic systems planning involves the allocation of systems resources at the macro level, which usually deals with a time frame of three to five years. This process is very similar to budgeting resources for other strategic activities, such as product development, plant expansions, market research, and manufacturing technology. For most companies, key inputs in developing a sound systems strategy include the strategic business needs of the organization, the legacy system situation, and user feedback.

Strategic Business Needs

All functional areas should support the business strategy of the organization. Because this is most certainly true for the information systems function, we begin with an overview of business strategy. We will briefly review some common aspects of business strategy that bear directly on developing a sound systems strategy.

1 Accountants and auditors are end users of some systems, but are the stakeholders in all accounting information systems.

Vision and Mission

Developing a systems strategy requires an understanding of top management's vision, which has shaped the organization's business strategy. Many CEOs communicate their strategic vision through a formal mission statement. In some cases, however, top management's strategic view for the company is not fully articulated or formulated. Organizations without a well-considered mission statement might have individuals who lack a clear vision for the future managing and directing them. Not surprisingly, companies in this situation often lack a viable systems strategy. Consequently, their management is prone to making knee-jerk responses to information systems needs that emerge out of crisis rather than planning.

Industry and Competency Analysis

In addition to needing a durable vision component, the strategic planning process has many dynamic business factors that drive it, including consolidations, competition, rapidly evolving technology, changes in the regulatory landscape, and increasing demands from stakeholders. Industry analysis and competency analysis are two strategic planning methodologies used to capture information on these factors.

Industry analysis provides management with an analysis of the driving forces that affect its industry and its organization's performance. Such analysis offers a fact-based perspective on the industry's important trends, significant risks, and potential opportunities that may impact the business's performance.

Competency analysis provides a complete picture of the organization's effectiveness as seen via four strategic filters: resources, infrastructure, products/services, and customers. By assessing these factors, an organization can develop an accurate view of its relative strengths, weaknesses, and core competencies. The analysis helps in developing strategic options, which are based on an understanding of the future environment and the firm's core competencies. Strategic opportunities may include market-entry options or new product development options.

In developing a business strategy many organizations perform competency analyses on their key competitors as well as potential business partners. By knowing the strengths and weaknesses of competitors, management can identify imminent threats and spot new business opportunities for growth. Similarly, by examining the competencies of potential trading partners, strategic gaps and/or synergies from the partnership may materialize.

Legacy Systems

Applications, databases, and business processes that are currently in full operation constitute a firm's legacy systems. Often, these are complicated systems to maintain and enhance. Even in modern companies, the information system is usually a mixture of old and modern technologies, which are critical to the organization's business success.

Legacy components need to be mapped to current business processes to determine the extent to which they support the mission of the company. This evaluation, together with an assessment of future strategic business needs, will enable management to develop the migration strategy needed to move from legacy systems to future systems with minimum disruption to business operations.

Developing an Architecture Description

System architecture is the structure of components, their interrelationships, and the principles and guidelines governing their design and evolution over time. An **architecture description** is a formal description of an information system, organized in a way that identifies the structural properties of the system and defines the components or building blocks that make up the overall information system. This description provides the elements for a plan from which new systems can be developed and commercial packages procured that will work together as harmonious components of the overall system. It also provides the technical foundation for a legacy migration strategy. Finally, the technical advantages that result from an architecture description translate into important business benefits, which are presented in Table 13-1.

User Feedback

Assessing user feedback involves identifying areas of user needs, preparing written proposals, evaluating each proposal's feasibility and contribution to the business plan, and prioritizing individual projects. User feedback at this point pertains to substantial, perceived problems rather than minor systems modifications, which are dealt with at a later point in the SDLC. Next, we examine the following key phases of this activity.

1. Recognizing the problem.
2. Defining the problem.
3. Specifying system objectives.
4. Determining project feasibility.
5. Preparing a formal project proposal.

Recognizing the Problem

The need for a new, improved information system may be manifested through various symptoms. In the early stages of a problem, these symptoms may seem vague and innocuous or may go unrecognized. However, as the underlying source of the problem grows in severity, so do its symptoms, until they are alarmingly apparent. At this point, operations may have reached a state of crisis. Therefore, the point at which the problem is recognized

TABLE 13-1 **Business Benefits from Architecture Description**

Efficient IT operation

- Lower software development, support, and maintenance costs.
- Increased portability of applications.
- Improved interoperability and easier system and network management.

Ability to address critical enterprise-wide issues

- Easier upgrade and exchange of system components.
- Better return on existing investment and reduced risk for future investment.
- Reduced complexity in IT infrastructure.
- Maximum return on investment in existing IT infrastructure.
- The flexibility to make, buy, or outsource IT solutions.
- Reduced risk overall in new investment and the costs of IT ownership.

Improved procurement

- Buying decisions are simpler because the information governing procurement is readily available in a coherent plan.
- The procurement process is faster, maximizing procurement speed and flexibility without sacrificing architectural coherence.

is important. This is often a function of the philosophy of a firm's management. The reactive management philosophy characterizes an extreme position; in contrast with this is the philosophy of proactive management.

Reactive management responds to problems only when they reach a crisis state and can no longer be ignored. This approach creates a great deal of pressure to solve the problem quickly once it has been recognized. Too often, this results in hurried analysis, incomplete problem identification, shortcuts in design, poor user participation, and the final product of a generally suboptimal solution.

Proactive management stays alert to the subtle signs of problems and aggressively looks for ways to improve the organization's systems. This management style is more likely to recognize symptoms early and, therefore, implement better solutions. Early problem detection avoids the crisis stage and provides the necessary time for a complete and thorough study.

Who reports problem symptoms? Typically, lower-level managers and operations personnel first report symptoms. Being in continuous contact with day-to-day operations, these individuals are quick to notice operational difficulties with customers, suppliers, and the financial community. As a result, most systems requests originate with lower-level management.

Defining the Problem

The manager must avoid the temptation to take a leap in logic from symptom recognition to problem definition. One must keep an open mind and avoid drawing conclusions about the nature of the problem that may channel attention and resources in the wrong direction. For example, increased product returns, excessive delays in product shipments to customers, excessive overtime for operations personnel, and slow inventory turnover rates are all problem symptoms. These are evidence of underlying problems, but they do not, in themselves, define the problems. The manager must learn enough about the problem to pursue a solution intelligently. The manager cannot, however, collect all the information needed to define the problem accurately and specify a solution. This would require a detailed system evaluation. The manager must specify the nature of the problem as he or she sees it based on the nature of the difficulties identified.

The manager reports this problem definition to the computer systems professionals within the firm. This begins an interactive process between the systems professionals and the user, which results in a formal project proposal that will go before the steering committee for approval. The following three stages in the planning phase—specifying system objectives, determining project feasibility, and preparing a formal project proposal—represent the cooperative efforts of the manager and the systems professional.

Specifying System Objectives

User information requirements need to be specified in terms of operational objectives for the new information system. For example, the user may need an order entry system that can handle 5,000 transactions per hour, maintain up-to-the-minute inventory status, and allow all orders received by 2 PM to be shipped to the customer by the end of the day. At this point, we need only define the objectives in general terms. More precise system requirements will be developed later in the SDLC.

Preliminary Project Feasibility

A preliminary **project feasibility** study is conducted at this early stage to determine how best to proceed with the project. By assessing the major constraints on the proposed system, management can evaluate the project's feasibility, or likelihood for success, before committing large amounts of financial and human resources. The acronym **TELOS** provides guidance for assessing project feasibility. The term stands for technical, economic, legal, operational, and schedule feasibility.

Technical feasibility is concerned with whether the system can be developed under existing technology or if new technology is needed. As a general proposition, the technology in the marketplace is far ahead of most firms' ability to apply it. Therefore, from an availability viewpoint, technical feasibility is not usually an issue. For most firms, the real issue is their desire and ability to apply available technology. Given that technology is the physical basis for most of the system's design features, this aspect bears heavily on the overall feasibility of the proposed system.

Economic feasibility pertains to the availability of funds to complete the project. At this point, we are concerned with management's financial commitment to this project in view of other competing capital projects under consideration. The level of available economic support directly impacts the operational nature and scope of the proposed system. Later, in the system justification and selection step, cost-benefit analysis is used to identify the best system design for the cost.

Legal feasibility involves ensuring that the proposed system is not in conflict with the company's ability to discharge its legal responsibilities. In previous chapters, we have studied the need to comply with the control requirement laid down in the Foreign Corrupt Practices Act of 1977, Statement on Auditing Standards No. 78, and Sarbanes-Oxley legislation. In addition, many regulations and statutes deal with invasion of privacy and the confidentiality of stored information. We must be certain the proposed system does not breach any legal boundaries.

Operational feasibility pertains to the degree of compatibility between the firm's existing procedures and personnel skills and the operational requirements of the new system. Implementing the new system may require adopting new procedures and retraining operations personnel. The question that must be answered is: can enough procedural changes be made, personnel retrained, and new skills obtained to make the system operationally feasible?

Schedule feasibility relates to the firm's ability to implement the project within an acceptable time. This feasibility factor impacts both the scope of the project and whether it will be developed in-house or purchased from a software vendor. If the project, as originally envisioned, cannot be produced internally by the target date, then its design, its acquisition method, or the target date must be changed.

Preparing a Formal Project Proposal

The **systems project proposal** provides management with a basis for deciding whether to proceed with the project. The formal proposal serves two purposes. First, it summarizes the findings of the study conducted to this point into a general recommendation for a new or modified system. This enables management to evaluate the perceived problem along with the proposed system as a feasible solution. Second, the proposal outlines the linkage between the objectives of the proposed system and the business objectives of the firm. It shows that the proposed new system complements the strategic direction of the firm. Figure 13-2 shows an example of a project proposal.

Develop a Strategic Systems Plan

After collecting and documenting input from the business plan, legacy issues, and user feedback, members of the steering committee and systems professionals evaluate the pros and cons of each proposal. This involves assessing each potential project's benefits, costs,

FIGURE 13-2 **System Project Proposal**

Project Proposal

Requested by: *J.J. Johnson* Date: *11/13/07*

Nature of System Requested: *Inventory Control System*

Reason for New System: *Better manage inventory, reduce obsolescence, increase turnover, and reduce inventory carrying costs*

Resource Requirements of New System:

	High	Moderate	Low
Personnel	☐	☐	☑
Hardware	☐	☑	☐
Software	☐	☑	☐

Rate project's feasibility factors on a scale of 1 to 10 where 10 is most feasible:

Technical Feasibility	*9*
Economic Feasibility	*8*
Legal Feasibility	*10*
Operational Feasibility	*10*
Schedule Feasibility	*8*

Project Priority: High ✓ Moderate ___ Low ___

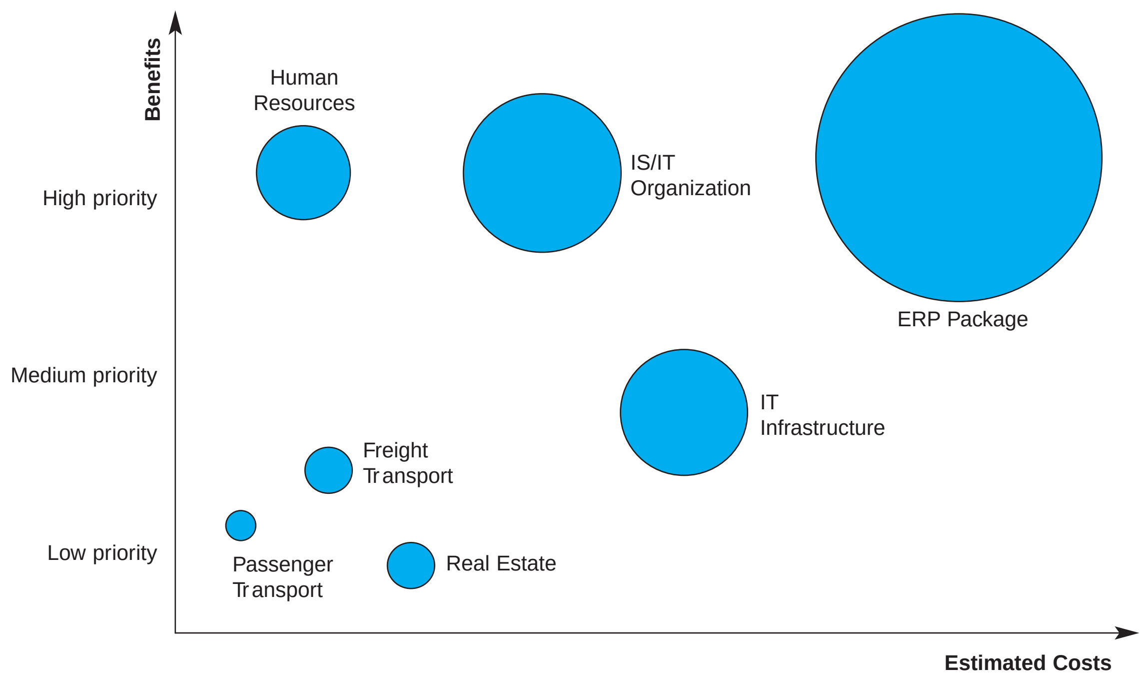
and strategic implications to the organization. Development will proceed on proposals that show the greatest potential for supporting the organization's business objectives at the lowest cost. Figure 13-3 shows how the merits of competing projects may be presented to provide a sense of relative scale. The vertical dimension shows project priority in terms of organizational need. The horizontal plane shows the expected costs of each project, and the size of the circle reflects the projects' strategic impact. For example, an enterprise resource planning (ERP) system is a high-priority project of great strategic importance. Such a project would, however, be extremely costly. On the other hand, the human resources project is of strategic importance also, but at a much lower cost.

Create an Action Plan

An important skill for top management is the ability to translate strategy into action. Although most U.S. companies are taking measures to decrease the distance between those who formulate the strategy and those who carry it out, translating vision into work is difficult. If organizations want to be successful, however, they must learn to implement strategy and beat the 90 percent failure rates experienced by their peers.[2]

2 D. Norton, "SAP Strategic Enterprise Management," Compass White Paper (1999).

FIGURE 13-3 Relationship between Priority, Cost, and Strategic Impact



The **balanced scorecard (BSC)** is a management system that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback both from internal business processes and external outcomes to continuously improve strategic performance. When fully deployed, the balanced scorecard transforms strategic planning from an academic exercise into operational tasks.

Today, the BSC enjoys increasing attention and is likely to become ubiquitous in senior management circles. Much of the BSC's appeal stems from its ability to integrate financial and operational measures into a single comprehensive framework that can "translate a company's strategic objectives into a coherent set of performance measures."[3]

The BSC approach lends itself especially well to one of the fundamental challenges facing CEOs and information technology (IT) executives, namely, how to measure, improve, and understand the value that IT delivers to the business.[4] The BSC can help managers identify opportunities for improvement in IT and track the impact of improvement initiatives through a wide range of performance indicators.

The BSC suggests that we view the organization from four perspectives. We develop metrics, collect data, and analyze it relative to each of the following perspectives:

1. The learning and growth perspective.
2. The internal business process perspective.
3. The customer perspective.
4. The financial perspective.

3 Robert S. Kaplan and David P. Norton, "Putting the Balanced Scorecard to Work," Harvard Business Review (January–February 1996).

4 "IT Efficiency and Business Value," Compass White Paper (July 1998).

The Learning and Growth Perspective

Learning and growth constitute the essential foundation for the success of any organization. This perspective includes employee training and corporate cultural attitudes related to both individual and corporate self-improvement. In our current climate of rapid technological change, workers need to be in a continuous learning mode. Government agencies often find themselves unable to hire new technical workers and at the same time are showing a decline in training existing employees. Metrics can be developed to guide managers in channeling training funds where they can be of greatest benefit.

The Internal Business Process Perspective

Metrics based on this perspective allow managers to know how well their business is running and whether its products and services conform to customer requirements. Those who know these processes most intimately need to carefully design these metrics.

The Customer Perspective

Recent management philosophy has shown an increasing realization of the importance of customer focus in any business. These are leading indicators: if customers are not satisfied, they will eventually find other suppliers that will meet their needs. Poor performance from this perspective predicts future decline, even though the current financial picture may look good. The customer perspective includes objective measurements such as customer retention rate, as well as more subjective criteria such as market research and customer satisfaction surveys.

The Financial Perspective

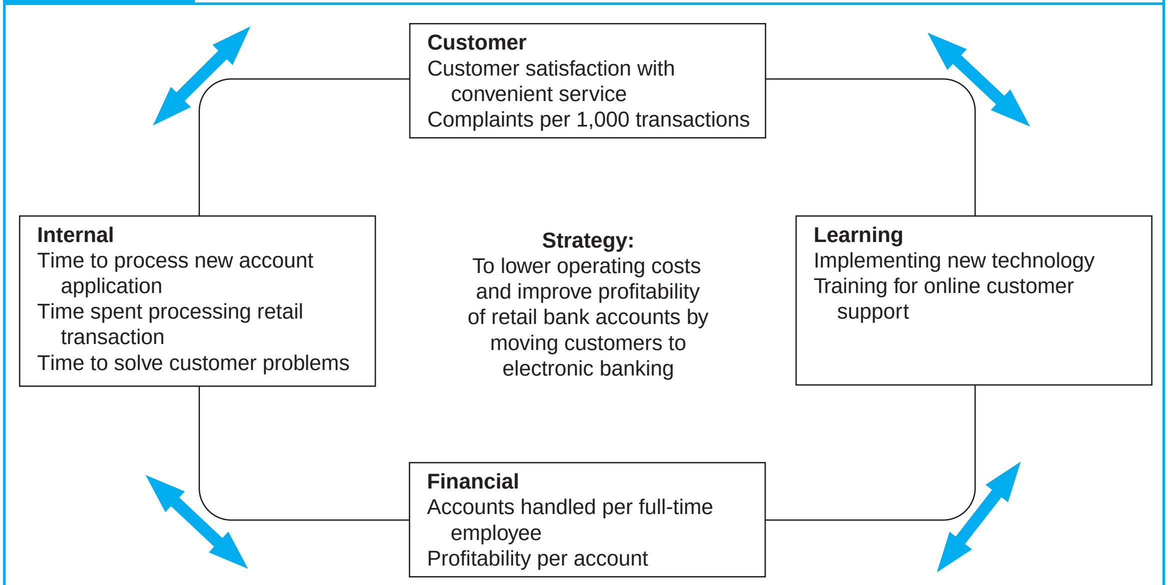
The financial perspective includes traditional measurements such as profitability, revenues, and sales. An overemphasis on financial performance, however, may stimulate short-run decisions that create an imbalance with other perspectives.

The power of the BSC model lies in the linkages between these four core measurement perspectives. Consider, for example, a business experiencing poor performance from a financial perspective, as measured by low sales growth, and from a customer perspective, as measured by low customer retention and satisfaction. Using the BSC approach, management can examine measures from the learning and innovation perspective and from the internal process perspective to identify root causes as well as potential solutions to the problem. By identifying imbalances that exist in these measurement areas, the scorecard can be used to take corrective action.

Balanced Scorecard Applied to IT Projects

Figure 13-4 illustrates a BSC that measures the business benefits of a hypothetical online banking proposal. The bank's retail customers are producing low profit margins because of the high overhead and service costs of managing their accounts. Electronic banking is seen as a way to address this problem. If a strategic goal is to increase account profitability, performance indicators such as numbers of accounts managed per full-time employee and cost per transaction are relevant measures. Relationships can be drawn between these measures. For example, hours spent training support staff can have an impact on reducing customer complaints.

FIGURE 13-4 **Balanced Scorecard for Online Banking System**



Source: Adapted from The Balanced Scorecard Collaborative, Inc.

Through analysis of BSC indicators, the steering committee can establish priorities to competing proposals based on their strategic impact as viewed from multiple perspectives. The committee will use these metrics to identify the proposals that go forward to the project initiation phase of the SDLC. This is the first major decision point in a project's life cycle. If the committee approves a proposal, then the proposal will undergo further detailed study and development. If a proposal is rejected, it will not be considered further within the current budget period.

Project Initiation

Project initiation involves obtaining a detailed understanding of the user problem and proposing multiple alternative solutions. Each of these proposals is assessed in terms of its feasibility and cost-benefit characteristics. The option selected at this step then proceeds to the construct phase of the SDLC. Depending upon the nature of the project and the needs of the organization, a system will require in-house development, a commercial package, or both. These approaches are examined in Chapter 14.

Systems Analysis

The systems analyst must fully understand a business problem before he or she can formulate a solution. An incomplete or defective analysis will lead to an incomplete or defective solution. Therefore, systems analysis is the foundation for the rest of the SDLC. **Systems analysis** is actually a two-step process involving an initial survey of the current system and then an analysis of the user's needs.

The Survey Step

Most systems are not developed from scratch. Usually, some form of information system and related procedures are currently in place. The analyst often begins the analysis by determining what elements, if any, of the current system should be preserved as part of the new system. This involves a rather detailed **system survey**. Facts pertaining to preliminary questions about the system are gathered and analyzed. As the analyst obtains a greater depth of understanding of the problem, he or she develops more specific questions for which more facts must be gathered. This process may go on through several iterations. When all the relevant facts have been gathered and analyzed, the analyst arrives at an assessment of the current system. Surveying the current system has both disadvantages and advantages.

Disadvantages of Surveying the Current System

Perhaps the most compelling argument against a current system survey centers on a phenomenon known as the current physical tar pit.[5] This is the tendency on the part of the analyst to be sucked in and then bogged down by the task of surveying the current dinosaur system.

Some argue that current system surveys stifle new ideas. By studying and modeling the old system, the analyst may develop a constrained notion about how the new system should function. The result is an improved old system rather than a radically new approach. An example is the implementation of an ERP system. The task of reviewing current organizational procedures may serve no purpose because the successful implementation of an ERP depends on reengineering these processes to employ the best business practices of the industry.

Advantages of Surveying the Current System

There are three advantages to studying the current system. First, it is a way to identify what aspects of the old system should be kept. Some elements of the system may be functionally sound and can provide the foundation for the new system. By fully understanding the current system, the analyst can identify those aspects worth preserving or modifying for use in the new system.

Second, when the new system is implemented, the users must go through a conversion process whereby they formally break away from the old system and move to the new one. The analyst must determine what tasks, procedures, and data will be phased out with the old system and which will continue. To specify these conversion procedures, the analyst must know not only what is to be done by the new system but also what was done by the old one. This requires a thorough understanding of the current system.

Finally, by surveying the current system, the analyst may determine conclusively the cause of the reported problem symptoms. Perhaps the root problem is not the information system at all; it may be a management or employee problem that can be resolved without redesigning the information system. We may not be able to identify the root cause of the problem if we discard the existing system without any investigation into the symptoms.

Gathering Facts

The survey of the current system is essentially a fact-gathering activity. The facts the analyst gathers are pieces of data that describe key features, situations, and relationships of the system. System facts fall into the following broad classes:

Data Sources. These include external entities, such as customers or vendors, as well as internal sources from other departments.

5 W. Keuffel, "House of Structure," *Unix Review* 9 (February 1991): 36.

Users. These include both managers and operations users.

Data Stores. Data stores are the files, databases, accounts, and source documents used in the system.

Processes. Processing tasks are manual or computer operations that represent a decision or an action that information triggers.

Data Flows. The movement of documents and reports between data sources, data stores, processing tasks, and users represent data flows.

Controls. These include both accounting and operational controls and may be manual procedures or computer controls.

Transaction Volumes. The analyst must obtain a measure of the transaction volumes for a specified period of time. Many systems are replaced because they have reached their capacity. Understanding the characteristics of a system's transaction volume and its rate of growth are important elements in assessing capacity requirements for the new system.

Error Rates. Transaction errors are closely related to transaction volume. As a system reaches capacity, error rates increase to an intolerable level. Although no system is perfect, the analyst must determine the acceptable error tolerances for the new system.

Resource Costs. The resources the current system uses include the costs of labor, computer time, materials (for example, invoices), and direct overhead. Any resource costs that disappear when the current system is eliminated are called escapable costs. Later, when we perform a cost-benefit analysis, escapable costs will be treated as benefits of the new system.

Bottlenecks and Redundant Operations. The analyst should note points where data flows come together to form a bottleneck. At peak-load periods, these can result in delays and promote processing errors. Likewise, delays may be caused by redundant operations, such as unnecessary approvals or sign-offs. By identifying these problem areas during the survey phase, the analyst can avoid making the same mistakes in the design of the new system.

Fact-Gathering Techniques

Systems analysts use several techniques to gather the above-cited facts. These include observation, task participation, personal interviews, and reviewing key documents.

Observation. Observation involves passively watching the physical procedures of the system. This allows the analyst to determine what gets done, who performs the task, when they do it, how they do it, why they do it, and how long it takes.

Task Participation. Participation is an extension of observation, whereby the analyst takes an active role in performing the user's work. This allows the analyst to experience firsthand the problems involved in the operation of the current system. For example, the analyst may work on the sales desk taking orders from customers and preparing sales orders. The analyst can determine that documents are improperly designed, that insufficient time exists to perform the required procedures, or that peak-load problems cause bottlenecks and processing errors. With hands-on experience, the analyst can often envision better ways to perform the task.

Personal Interviews. Interviewing is a method of extracting facts about the current system and user perceptions about the requirements for the new system. The instruments used to gather these facts may be open-ended questions or formal questionnaires.

Open-ended questions allow users to elaborate on the problem as they see it and offer suggestions and recommendations. Answers to these questions tend to be difficult to analyze, but they give the analyst a feel for the scope of the problem. The analyst in this type of interview must be a good listener and able to focus on the important facts. Examples of open-ended questions are: "What do you think is the main problem with our sales order system?" and "How could the system be improved?"

Questionnaires are used to ask more specific, detailed questions and to restrict the user's responses. This is a good technique for gathering objective facts about the nature of specific procedures, volumes of transactions processed, sources of data, users of reports, and control issues.

Reviewing Key Documents. The organization's documents are another source of facts about the system being surveyed. Examples of these include the following:

- Organizational charts
- Job descriptions
- Accounting records
- Charts of accounts
- Policy statements
- Descriptions of procedures
- Financial statements
- Performance reports
- System flowcharts
- Source documents
- Transaction listings
- Budgets
- Forecasts
- Mission statements

Following the fact-gathering phase, the analyst formally documents his or her impressions and understanding about the system. This will take the form of notes, system flowcharts, and various levels of data flow diagrams.

The Analysis Step

Systems analysis is an intellectual process that is commingled with fact gathering. The analyst is simultaneously analyzing as he or she gathers facts. The mere recognition of a problem presumes some understanding of the norm or desired state. It is therefore difficult to identify where the survey ends and the analysis begins.

System Analysis Report

The event that marks the conclusion of the systems analysis phase is the preparation of a formal **systems analysis report**. This report presents management or the steering committee with the survey findings, the problems identified with the current system, the user's needs, and the requirements of the new system. Figure 13-5 contains a possible format for this report.

The primary purpose for conducting systems analysis is to identify user needs and specify requirements for the new system. The report should set out in detail what the system must do rather than how to do it. The requirements statement within the report establishes an understanding between systems professionals, management, users, and other stakeholders. This document constitutes a formal contract that specifies the objectives and goals of the system. The systems analysis report should establish in clear terms the data sources, users, data files, general processes, data flows, controls, and transaction volume capacity.

The systems analysis report does not specify the detailed design of the proposed system. For example, it does not specify processing methods, storage media, record structures, and other details needed to design the physical system. Rather, the report remains at the objectives level to avoid placing artificial constraints on the conceptual design phase. Several possible designs may serve the user's needs, and the development process must be free to explore all of these.

FIGURE 13-5 **Outline of Main Topics in a Systems Analysis Report**

Systems Analysis Report

I. Reasons for System Analysis
   A. Reasons specified in the system project proposal
   B. Changes in reasons since analysis began
   C. Additional reasons

II. Scope of Study
   A. Scope as specified by the project proposal
   B. Changes in scope

III. Problems Identified with Current System
   A. Techniques used for gathering facts
   B. Problems encountered in the fact-gathering process
   C. Analysis of facts

IV. Statement of User Requirements
   A. Specific user needs in key areas, such as:
      1. Output requirements
      2. Transaction volumes
      3. Response time
   B. Nontechnical terms for a broad-based audience, including:
      1. End users
      2. User management
      3. Systems management
      4. Steering committee

V. Resource Implications
   A. Preliminary assessment of economic effect
   B. Is economic feasibility as stated in proposal reasonable?

VI. Recommendations
   A. Should the project continue?
   B. Has analysis changed feasibility, strategic impact, or priority of the project?

Conceptualization of Alternative Designs

The purpose of the conceptualization phase is to produce several alternative conceptual solutions that satisfy the system requirements identified during systems analysis. By presenting users with a number of plausible alternatives, the project team avoids imposing preconceived constraints onto the new system. These alternative designs then go to the systems selection stage, where their respective costs and benefits are compared and a single optimum design is chosen for construction.

How Much Design Detail Is Needed?

The conceptual design phase should highlight the differences between critical features of competing systems rather than their similarities. Therefore, system designs at this point should be general. The designs should identify all the inputs, outputs, processes, and special features necessary to distinguish one alternative from another. In some cases, this may be accomplished at the context diagram level. In situations where the important distinctions between systems are subtle, designs may need to be represented by lower-level DFDs and even with structure diagrams. However, detailed DFDs and structure diagrams are more commonly used at the detailed design phase of the SDLC. We shall discuss the transition from detailed DFD to structure diagram in Chapter 14.

Figure 13-6 presents two alternative conceptual designs for a purchasing system. These designs lack the details needed to implement the system. For instance, they do not include such necessary components as:

- Database record structures.
- Processing details.
- Specific control techniques.
- Formats for input screens and source documents.
- Output report formats.

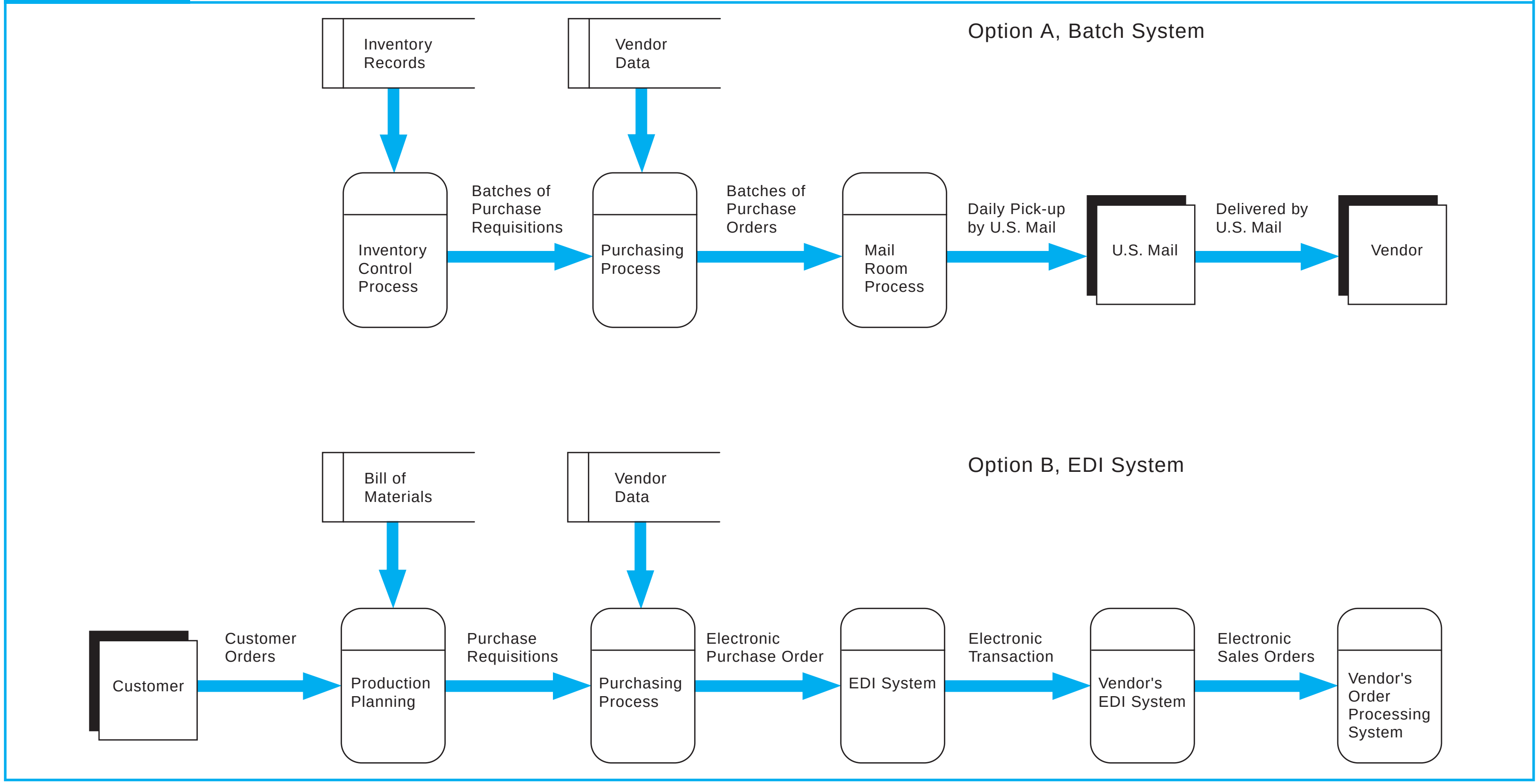
The designs do, however, possess sufficient detail to demonstrate how the two systems are conceptually different in their functions. To illustrate, let's examine the general features of each system.

Option A is a traditional batch purchasing system. The initial input for the process is the purchase requisition from inventory control. When inventories reach their predetermined reorder points, new inventories are ordered according to their economic order quantity. Transmittal of purchase orders to suppliers takes place once a day via the U.S. mail.

In contrast, Option B employs electronic data interchange (EDI) technology. The trigger to this system is a purchase requisition from production planning. The purchases system determines the quantity and the vendor and then transmits the order online via EDI software to the vendor.

Both alternatives have pros and cons. A benefit of Option A is its simplicity of design, ease of implementation, and lower demand for systems resources than Option B. A negative aspect of Option A is that it requires the firm to carry inventories. On the other hand, Option B may allow the firm to reduce or even eliminate inventories. This benefit comes at the cost of more expensive and sophisticated system resources. It is premature, at this point, to attempt to evaluate the relative merits of these alternatives. This is done formally in the next phase of the SDLC. At this point, system designers are concerned only with identifying plausible alternative designs.

FIGURE 13-6 **Alternative Conceptual Designs for a Purchasing System**



Systems Evaluation and Selection

This phase in the SDLC is a formal mechanism for selecting the one system from the set of alternative conceptual designs that will go forward for construction. The **systems evaluation and selection** phase is an optimization process that seeks to identify the best system. This decision represents a critical juncture in the SDLC. At this point, there is a great deal of uncertainty about the system, and a poor decision can be disastrous. The purpose of a formal evaluation and selection procedure is to structure this decision-making process and thereby reduce both uncertainty and the risk of making a poor decision.

There is no magic formula to ensure a good decision. Ultimately, the decision comes down to management judgment. The objective is to provide a means by which management can make an informed judgment. This selection process involves two steps:

1. Perform a detailed feasibility study.
2. Perform a cost-benefit analysis.

The results of these evaluations are then reported formally to the steering committee for final system selection.

Perform a Detailed Feasibility Study

We begin the system selection process by reexamining the feasibility factors that were evaluated on a preliminary basis as part of the systems proposal. Originally, the scores assigned to these factors were based largely on the judgment and intuition of the systems professional. Now that specific system features have been conceptualized, the designer has a clearer picture of these factors. Also, at the proposal stage, these factors were evaluated for the entire project. Now they are evaluated for each alternative conceptual design.

Informed evaluators should perform the **detailed feasibility study**. Objectivity is essential to a fair assessment of each design. This group should consist of the project manager, a user representative, and systems professionals who have expertise in the specific areas that the feasibility study covers. Also, for operational audit reasons, the group should contain a member of the internal audit staff. The feasibility factors that were introduced in the previous section provide a framework for identifying the key issues that evaluators should consider.

Technical Feasibility

In evaluating technical feasibility, a well-established and understood technology represents less risk than an unfamiliar one. If the systems design calls for established technology, the feasibility score will be high, say 9 or 10. The use of technology that is new (first release) and unfamiliar to systems professionals who must install and maintain it, or that is a hybrid of several vendors' products, is a more risky option. Depending on the number and combination of risk factors, the feasibility score for such technology will be lower.

Legal Feasibility

In financial transaction processing systems, the legality of the system is always an issue. However, legality is also an issue for nonfinancial systems that process sensitive data, such as hospital patient records or personal credit ratings. Different systems designs may represent different levels of risk when dealing with such data. The evaluator should be concerned that the conceptual design recognizes critical control, security, and audit trail issues and that the system does not violate laws pertaining to rights of privacy and/or the use and distribution of information.

Operational Feasibility

The availability of well-trained, motivated, and experienced users is the key issue in evaluating the operational feasibility of a design. If users lack these attributes, the move to a highly technical environment may be risky and will require extensive retraining. This may also affect the economic feasibility of the system. On the other hand, a user community that is comfortable with technology is more likely to make a smooth transition to an advanced technology system. The operational feasibility score of each alternative design should reflect the expected ease of this transition.

Schedule Feasibility

At this point in the design, the system evaluator is in a better position to assess the likelihood that the system will be completed on schedule. The technology platform, the systems design, and the need for user training may influence the original schedule. The systems development technology being used is another influence. The use of computer-aided software engineering (CASE) and prototyping tools (discussed in Chapter 14) can significantly reduce the development time of any systems design option.

Economic Feasibility

The preliminary economic feasibility study was confined to assessing management's financial commitment to the overall project. This is still a relevant issue. Whether the economic climate has changed since the preliminary study or whether one or more of the competing designs does not have management's support should now be determined.

The original feasibility study could specify the project's costs only in general terms. Now that each competing design has been conceptualized and expressed in terms of its unique features and processes, designers can be more precise in their estimates of the costs of each alternative. The economic feasibility study can now be taken a step further by performing a cost-benefit analysis.

Perform Cost-Benefit Analysis

Cost-benefit analysis helps management determine whether (and by how much) the benefits received from a proposed system will outweigh its costs. This technique is frequently used for estimating the expected financial value of business investments. In this case, however, the investment is an information system, and the costs and benefits are more difficult to identify and quantify than those of other types of capital projects. Although imperfect in this setting, cost-benefit analysis is employed because of its simplicity and the absence of a clearly better alternative. In spite of its limitations, cost-benefit analysis, combined with feasibility factors, is a useful tool for comparing competing systems designs.

There are three steps in the application of cost-benefit analysis: identifying costs, identifying benefits, and comparing costs and benefits.

Identify Costs

One method of identifying costs is to divide them into two categories: one-time costs and recurring costs. One-time costs include the initial investment to develop and implement the system. Recurring costs include operating and maintenance costs that recur over the life of the system. Table 13-2 shows a breakdown of typical one-time and recurring costs.

TABLE 13-2 One-Time and Recurring Costs

One-Time Costs	
	Hardware acquisition
	Site preparation
	Software acquisition
	Systems design
	Programming and testing
	Data conversion from old system to new system
	Training personnel
Recurring Costs	
	Hardware maintenance
	Software maintenance contracts
	Insurance
	Supplies
	Personnel

One-Time Costs

Hardware Acquisition. This includes the cost of mainframe servers, PCs, and peripheral equipment, such as networks and disk packs. The cost figures for items can be obtained from the vendor.

Site Preparation. This involves such frequently overlooked costs as building modifications, for example, adding air-conditioning or making structural changes; equipment installation, which may include the use of heavy equipment; and freight charges. Estimates of these costs can be obtained from the vendor and the subcontractors who do the installation.

Software Acquisition. These costs apply to all software purchased for the proposed system, including operating system software, if not bundled with the hardware; network control software; and commercial applications, such as accounting packages. Estimates of these costs can be obtained from vendors.

Systems Design. These are the costs that systems professionals incur performing the planning, analysis, and design functions. Technically, such costs incurred up to this point are sunk and irrelevant to the decision. The analyst should estimate only the costs needed to complete the detailed design.

Programming and Testing. Programming costs are based on estimates of the personnel hours required to write new programs and modify existing programs for the proposed system. System testing costs involve bringing together all the individual program modules for testing as an entire system. This must be a rigorous exercise if it is to be meaningful. The planning, testing, and analysis of the results may demand many days of involvement from systems professionals, users, and other stakeholders of the system. The experience of the firm in the past is the best basis for estimating these costs.

Data Conversion. These costs arise in the transfer of data from one storage medium or structure to another. For example, the accounting records of a manual system must be converted to digital form when the system becomes computer-based. This can represent a significant task. The basis for estimating conversion costs is the number and size of the files to be converted.

Training. These costs involve educating users to operate the new system. This could be done in an extensive training program that an outside organization provides at a remote site or through on-the-job training by in-house personnel. The cost of formal training can be easily obtained. The cost of an in-house training program includes instruction time, classroom facilities, and lost productivity.

Recurring Costs

Hardware Maintenance. This involves the cost of upgrading the computer (for example, increasing the memory), as well as preventive maintenance and repairs to the computer and peripheral equipment. The organization may enter into a maintenance contract with the vendor to minimize and budget these costs. Estimates for these costs can be obtained from vendors and existing contracts.

Software Maintenance. These costs include upgrading and debugging operating systems, purchased applications, and in-house developed applications. Maintenance contracts with software vendors can be used to specify these costs fairly accurately. Estimates of in-house maintenance can be derived from historical data.

Insurance. This covers such hazards and disasters as fire, hardware failure, vandalism, and destruction by disgruntled employees.

Supplies. These costs are incurred through routine consumption of such items as printer cartridges and paper, magnetic disks, magnetic tapes, and general office supplies.

Personnel. These are the salaries of individuals who are part of the information system. Some employee costs are direct and easily identifiable, such as the salaries of operations personnel exclusively employed as part of the system under analysis. Some personnel involvement, for example, the database administrator and computer room personnel, is common to many systems. Such personnel costs must be allocated on the basis of expected incremental involvement with the system.

Identify Benefits

The next step in the cost-benefit analysis is to identify the benefits of the system. These may be both tangible and intangible.

Tangible Benefits. Tangible benefits are benefits that can be measured and expressed in financial terms. Table 13-3 lists several types of tangible benefits.

Tangible benefits fall into two categories: those that increase revenue and those that reduce costs. For example, assume a proposed EDI system will allow the organization to reduce inventories and at the same time improve customer service by reducing stockouts. The reduction of inventories is a cost-reducing benefit. The proposed system will use fewer resources (inventories) than the current system. The value of this benefit is the dollar amount of the carrying costs that the annual reduction in inventory saves. The estimated increase in sales because of better customer service is a revenue-increasing benefit.

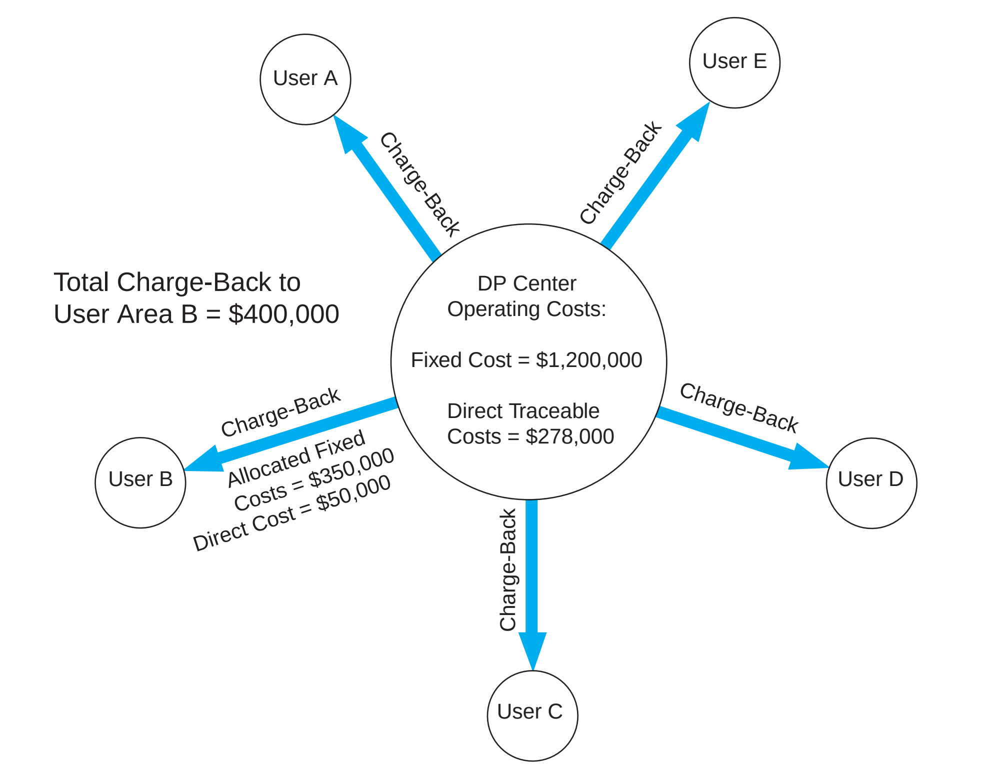
When measuring cost savings, only escapable costs should be included in the analysis. Escapable costs are directly related to the system and cease to exist when the system ceases to exist. Some costs that appear to be escapable to the user are not truly escapable

TABLE 13-3	Tangible Benefits
	Increased Revenues
	Increased sales within existing markets
	Expansion into other markets
	Cost Reduction
	Labor reduction
	Operating cost reduction (such as supplies and overhead)
	Reduced inventories
	Less expensive equipment
	Reduced equipment maintenance

and, if included, can lead to a flawed analysis. For example, data processing centers often charge back their operating costs to their user constituency through cost allocations. The charge-back rate they use for this includes both fixed costs (allocated to users) and direct costs that the activities of individual users create. Figure 13-7 illustrates this technique.

Assume the management in User Area B proposes to acquire a computer system and perform its own data processing locally. One benefit of the proposal is the cost savings derived by escaping the charge-back from the current data processing center. Although the user may see this as a $400,000 annual charge, the organization as a whole can only

FIGURE 13-7 DP Center Cost Charge-Back to User Areas



escape the direct cost portion ($50,000). Should the proposal be approved, the remaining $350,000 of the charge-back does not go away. The remaining users of the current system must now absorb this cost.

Intangible Benefits. Table 13-4 lists some common categories of intangible benefits. Although intangible benefits are often of overriding importance in information system decisions, they cannot be easily measured and quantified. For example, assume that a proposed point-of-sale system for a department store will reduce the average time to process a customer sales transaction from 11 minutes to 3 minutes. The time saved can be quantified and produces a tangible benefit in the form of an operating cost savings. An intangible benefit is improved customer satisfaction; no one likes to stand in long lines to pay for purchases. But what is the true value of this intangible benefit to the organization? Increased customer satisfaction may translate into increased sales. More customers will buy at the store—and may be willing to pay slightly more to avoid long checkout lines. But how do we quantify this translation? Assigning a value is often highly subjective.

Systems professionals draw upon many sources in attempting to quantify intangible benefits and manipulate them into financial terms. Some common techniques include customer (and employee) opinion surveys, statistical analysis, expected value techniques, and simulation models. Though systems professionals may succeed in quantifying some of these intangible benefits, more often they must be content to simply state the benefits as precisely as good judgment permits.

Because they defy precise measurement, intangible benefits are sometimes exploited for political reasons. By overstating or understating these benefits, a system's proponents may push it forward or its opponents may kill it.

Compare Costs and Benefits

The last step in the cost-benefit analysis is to compare the costs and benefits identified in the first two steps. The two most common methods used for evaluating information systems are net present value and payback.

The Net Present Value Method. Under the **net present value method**, the present value of the costs is deducted from the present value of the benefits over the life of the system. Projects with a positive net present value are economically feasible. When comparing competing projects, the optimal choice is the project with the greatest net present value. Figure 13-8 illustrates the net present value method by comparing two competing designs.

TABLE 13-4	**Intangible Benefits**
	Increased customer satisfaction
	Improved employee satisfaction
	More current information
	Improved decision making
	Faster response to competitor actions
	More efficient operations
	Better internal and external communications
	Improved planning
	Operational flexibility
	Improved control environment

FIGURE 13-8 Net Present Value Method of Cost-Benefit Analysis

Beginning Year Time	End Year Outflows	Inflows	Beginning Year Time	End Year Outflows	Inflows
0	$(300,000)		0	$(140,000)	
1	(45,000)	170,000	1	(55,000)	135,000
2	(45,000)	170,000	2	(55,000)	135,000
3	(45,000)	170,000	3	(55,000)	135,000
4	(45,000)	170,000	4	(55,000)	135,000
5	(45,000)	170,000	5	(55,000)	135,000
PV Out	$(479,672)		PV Out	$(359,599)	
PV In	$628,482		PV In	$499,089	
NPV	$148,810		NPV	$139,490	
Interest Rate	8.00%				

The example is based on the following data:

	Design A	Design B
Project completion time	1 year	1 year
Expected useful life of system	5 years	5 years
One-time costs (thousands)	$300	$140
Recurring costs (thousands) incurred at beginning of Years 1 through 5	$45	$55
Annual tangible benefits (thousands) incurred at end of Years 1 through 5	$170	$135

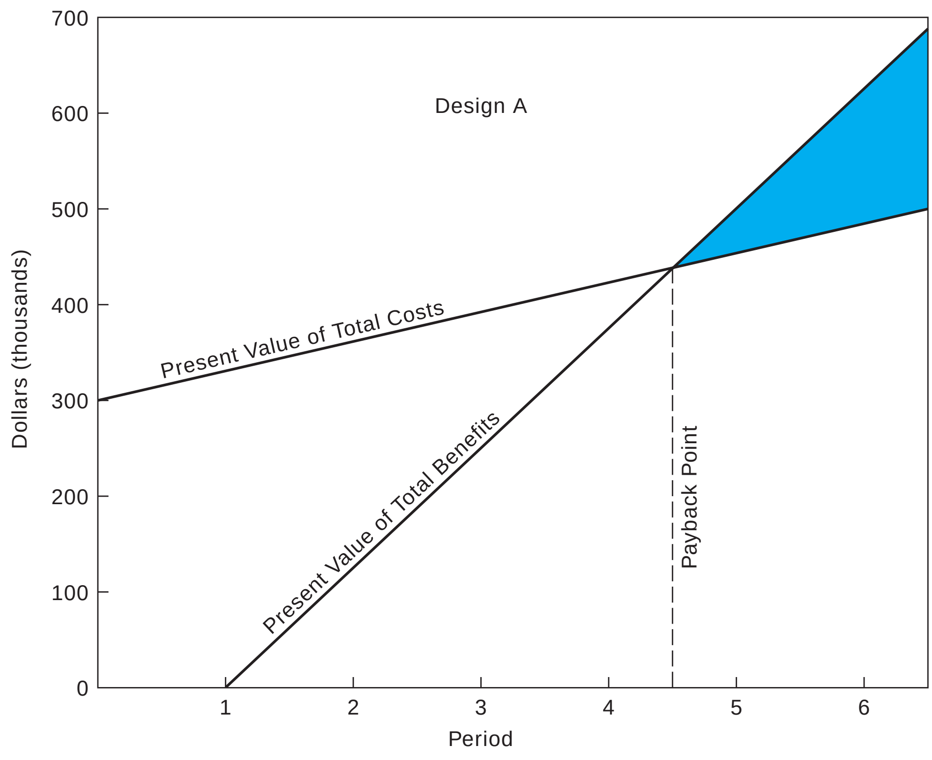
If costs and tangible benefits alone were being considered, then Design A would be selected over Design B. However, the value of intangible benefits, along with the design feasibility scores, must also be factored into the final analysis.

The Payback Method. The **payback method** is a variation of break-even analysis. The break-even point is reached when total costs equal total benefits. Figures 13-9(a) and (b) illustrate this approach using the data from the previous example.

The total cost curve consists of the one-time costs plus the present value of the recurring costs over the life of the project. The total benefits curve is the present value of the tangible benefits. The intersection of these lines represents the number of years into the future when the project breaks even, or pays for itself. The shaded area between the benefit curve and the total cost curve represents the present value of future profits that the system earned.

In choosing an information system, payback speed is often a decisive factor. With brief product life cycles and rapid advances in technology, the effective lives of information systems tend to be short. Using this criterion, Design B, with a payback period of four years, would be selected over Design A, whose payback will take four and a half years. The length of the payback period often takes precedence over other considerations represented by intangible benefits.

FIGURE 13-9(a) **Discounted Payback Method of Cost-Benefit Analysis**



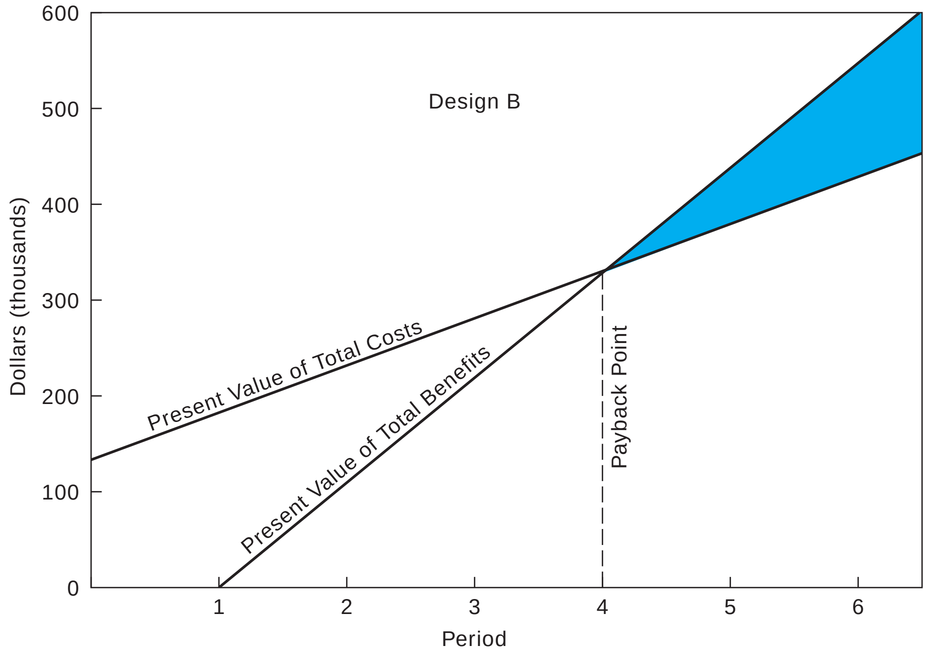
Prepare Systems Selection Report

The deliverable portion of the systems selection process is the **systems selection report**. This formal document consists of a revised feasibility study, a cost-benefit analysis, and a list and explanation of intangible benefits for each alternative design. On the basis of this report, the steering committee will select a single system that will go forward to the next phase of the construct phase of the SDLC.

In-House Development or Purchase Commercial Software

Two general options are open to the organization in the construct phase: develop the system in-house or purchase commercial software. At this juncture, management should have a good sense as to which option it will follow. Systems that need to meet unique and proprietary business needs are more likely to undergo in-house development. Systems that are expected to support best industry practices may be better suited to the purchased-software option. A third approach, which involves both options, is to tailor the commercial system to meet the organization's needs. This may require making extensive in-house modifications to the package. The previous analysis of system architecture, TELOS factors, system survey results, and preliminary cost-benefit issues will have revealed to decision makers the suitability of one approach over the other. Both the in-house and the commercial package options are examined in detail in Chapter 14.

FIGURE 13-9(b) Discounted Payback Method of Cost-Benefit Analysis (*Continued*)



Announcing the New System Project

Management's formal announcement of the new system to the rest of the organization is the last and most delicate step in the project initiation phase of the SDLC. This exceedingly important communiqué, if successful, will pave the way for the new system and help ensure its acceptance among the user community.

A new system can sometimes generate considerable political backlash that may threaten its success. For example, not all users may understand the objectives of the new system. In fact, the uncertainty surrounding the system may cause some users to feel threatened. As we have seen, new systems must improve the productivity and efficiency of operations. These objectives sometimes translate into organizational restructuring that erodes the personal powerbase of some users. Because a new system brings about operational changes, some employees may be displaced or may be required to undergo retraining to function in the new workplace.

The fears that take root and grow in this environment of uncertainty are often revealed in acts of opposition, both overt and covert, to the new system. To minimize opposition, top management must quell unnecessary fears and fully explain the business rationale for the new system before formal construction begins. If lower-level management and operating staff are assured that the system will be beneficial, the project's chances for success are vastly improved.

User Feedback

The preceding discussion was based on the assumption that the project under development passed through the strategic planning phase presented in the previous section. Not all systems projects should be, or can be, initiated in this manner. Systems maintenance is an integral component of the modern SDLC environment. This function needs to be receptive to user feedback and responsive to their legitimate needs. Therefore, user requests are also directed to the project initiation phase (refer to Figure 13-1). At this point in the SDLC, user requests involve relatively small enhancements to existing systems rather than major retrofits or entirely new systems. The IT budget must, therefore, be flexible enough to accommodate short-term quick hit projects that emerge on a daily basis.

The Accountant's Role in Managing the SDLC

The SDLC process is of interest to accountants for two reasons. First, the creation of an information system represents a significant financial transaction that consumes both financial and human resources. Systems development is like any manufacturing process that produces a complex product through a series of stages. Such transactions must be planned, authorized, scheduled, accounted for, and controlled. Accountants are as concerned with the integrity of this process as they are with any manufacturing process that has financial resource implications.

The second, and more pressing, concern for accountants is with the products that emerge from the SDLC. The quality of accounting information systems rests directly on the SDLC activities that produce them. These systems are used to deliver accounting information to internal and external users. The accountant's responsibility is to ensure that the systems apply proper accounting conventions and rules and possess adequate controls. Therefore, accountants are concerned with the quality of the process that produces accounting information systems. For example, a sales order system produced by a defective SDLC may suffer from serious control weaknesses that introduce errors into databases and, ultimately, the financial statements.

How Are Accountants Involved with SDLC?

Accountants are involved in systems development in three ways. First, accountants are users. All systems that process financial transactions impact the accounting function in some way. Like all users, accountants must provide a clear picture of their problems and needs to the systems professional. For example, accountants must specify accounting techniques to be used; internal control requirements, such as audit trails; and special algorithms, such as depreciation models.

Second, accountants participate in systems development as members of the development team. Their involvement often extends beyond the development of strictly accounting information systems (AIS) applications. Systems that do not process financial transactions may still draw on accounting data. The accountant may be consulted to provide advice or to determine if the proposed system constitutes an internal control risk.

Third, accountants are involved in systems development as auditors. Accounting information systems must be auditable. Some computer audit techniques require special features that must be designed into the system. The auditor/accountant has a stake in such systems and must be involved early in their design.

The Accountant's Role in Systems Strategy

Auditors routinely review the organization's systems strategy. History has shown that careful systems planning is a cost-effective activity in reducing the risk of creating unneeded, unwanted, inefficient, and ineffective systems. Both internal and external auditors have vested interests in this outcome.

The Accountant's Role in Conceptual Design

The accountant plays an important role in the conceptual design of the system. He or she must recognize control implications of each alternative design and ensure that accounting conventions and legal requirements are understood. These issues need not be specified in detail at this point, but they should be recognized as items to be addressed during the construct phase of the system. Furthermore, the auditability of a system depends in part on its design characteristics. Some computer auditing techniques require systems to be designed with built-in audit features. Such features require resources and need to be considered at conceptual design.

The Accountant's Role in Systems Selection

The economic feasibility of proposed systems is of primary concern to accountants. Specifically, the accountant should ensure that:

- Only escapable costs are used in calculations of cost-savings benefits.
- Reasonable interest rates are used in measuring present values of cash flows.
- One-time and recurring costs are completely and accurately reported.
- Realistic useful lives are used in comparing competing projects.
- Intangible benefits are assigned reasonable financial values.

Errors, omissions, and misrepresentations in the accounting for such items can distort the analysis and result in a suboptimal decision.

Summary

This chapter dealt with managing the SDLC. It began with a review of the key phases of a modern SDLC. The first of these involves strategic systems planning, which derives input from the strategic business plan, the diverse needs and concerns of the user community, and the organization's existing legacy system.

The chapter then reviewed the project initiation phase of the SDLC. This includes systems analysis and conceptualization of alternative designs. To ensure a correct systems solution, management must gather and weigh relevant information regarding the various systems alternatives under consideration. Systems evaluation and final selection is accomplished through a detailed feasibility study and careful cost-benefit analysis of these alternative solutions. Because success at this stage depends, in large part, on an accurate identification of prospective costs and benefits, we devoted special attention to the principle of one-time and recurring costs associated with systems and to the various tangible and intangible benefits they can be expected to yield. The chapter concluded with a review of the accountant's role in managing the SDLC.

Key Terms

architecture description (628)
balanced scorecard (BSC) (633)
competency analysis (628)
cost-benefit analysis (643)
detailed feasibility study (642)
economic feasibility (631)
end users (627)
industry analysis (628)
legal feasibility (631)
net present value method (647)
operational feasibility (631)
payback method (648)
proactive management (630)
project feasibility (630)
reactive management (630)
schedule feasibility (631)
stakeholders (627)
steering committee (627)
system survey (636)
systems analysis (635)
systems analysis report (638)
systems development life cycle (SDLC) (625)
systems evaluation and selection (642)
systems professionals (627)
systems project proposal (631)
systems selection report (649)
systems strategy (627)
technical feasibility (631)
TELOS (631)

Review Questions

1. What are the five stages of the systems development life cycle?
2. What is the balanced scorecard?
3. What is the role of the accountant in the SDLC? Why might accountants be called on for input into the development of a nonaccounting information system?
4. What is the learning and growth perspective?
5. Why is it often difficult to obtain competent and meaningful user involvement in the SDLC?
6. Is the SDLC a step-by-step procedure that must be followed precisely, or is it more interactive and recursive? Explain your answer.
7. Explain why a survey of the current system may serve no purpose when an organization is planning to implement an ERP.
8. Why is it crucial that the strategic objectives of the firm be considered when conducting the systems planning phase?
9. Who should sit on the systems steering committee? What are their typical responsibilities?
10. Explain the internal business process perspective.
11. Contrast proactive and reactive management styles. Which style would you prefer for your organization? Why?
12. What purposes do system objectives serve? Should they be broadly or narrowly defined? Why?
13. Why can the formal announcement of a new system technique be crucial?
14. Discuss the various feasibility measures that should be considered. Give an example of each.
15. What are the broad classes of facts that need to be gathered in the system survey?
16. What are the primary fact-gathering techniques?
17. What are the relative merits and disadvantages of a current system survey?
18. What is the primary objective of conceptual design?
19. How much design detail is needed in the conceptual design phase?
20. What is the accountant's primary role in conceptual design?
21. Who should be included in the group of evaluators performing the detailed feasibility study?

22. What makes the cost-benefit analysis more difficult for information systems than most other investments an organization may make?
23. Classify each of the following as either one-time or recurring costs:
    a. training personnel
    b. initial programming and testing
    c. systems design
    d. hardware costs
    e. software maintenance costs
    f. site preparation
    g. rent for facilities
    h. data conversion from old system to new system
    i. insurance costs
    j. installation of original equipment
    k. hardware upgrades
24. Distinguish between escapable and inescapable costs. Give an example of each.
25. Distinguish between tangible and intangible benefits.
26. What is a systems selection report?
27. Explain the net present value and the payback methods. Which method do you prefer? Why?
28. What is the role of the accountant in evaluation and selection?

Discussion Questions

1. Accounting educators are discussing ways to incorporate communication skills, both oral and written, into accounting information systems courses. Why do you think these skills are deemed crucial for proper execution of the SDLC?
2. Comment on the following statement: "The maintenance stage of the SDLC involves making trivial changes to accommodate changes in user needs."
3. Discuss how rushing the system's requirements stage may delay or even result in the failure of a systems development process. Conversely, discuss how spending too long in this stage may result in analysis paralysis.
4. Discuss the independence issue when audit firms also provide consulting input into the development and selection of new systems.
5. Should system users perform the systems development tasks or should these tasks be left to systems professionals who are trained specifically in systems development techniques? Why?
6. Why are the customer perspective measures important when a company is doing financially well?
7. Some may argue that a company's financial bottom line is all important. Comment on this from the financial perspective of the BSC approach.
8. Is a good strategic plan detail-oriented?
9. Distinguish between a problem and a symptom. Give an example. Are these usually noticed by upper-, middle-, or lower-level managers?
10. What purposes does the systems project proposal serve? How are these evaluated and prioritized? Is the prioritizing process objective or subjective?
11. Most firms underestimate the cost and time requirements of the SDLC by as much as 50 percent. Why do you think this occurs? In what stages do you think the underestimates are most dramatic?
12. A lack of top management support has led to the downfall of many new systems projects during the implementation phase. Why is this support so important?
13. Many new systems projects grossly underestimate transaction volumes because they do not take into account how the new, improved system can actually increase demand. Explain how this can happen and give an example.
14. Do you think legal feasibility is an issue for a system that incorporates the use of machines to sell lottery tickets?

Multiple-Choice Questions

1. All of the following individuals would likely be SDLC participants EXCEPT
   a. accountants.
   b. shareholders.
   c. management.
   d. programmers.
   e. all of the above.
2. Which of the following represents the correct order in problem resolution?
   a. Define the problem, recognize the problem, perform feasibility studies, specify system objectives, and prepare a project proposal.
   b. Recognize the problem, define the problem, perform feasibility studies, specify system objectives, and prepare a project proposal.
   c. Define the problem, recognize the problem, specify system objectives, perform feasibility studies, and prepare a project proposal.
   d. Recognize the problem, define the problem, specify system objectives, perform feasibility studies, and prepare a project proposal.
3. A feasibility study for a new computer system should
   a. consider costs, savings, controls, profit improvement, and other benefits analyzed by application area.
   b. provide the preliminary plan for converting existing manual systems and clerical operations.
   c. provide management with assurance from qualified, independent consultants that the use of a computer system appeared justified.
   d. include a report by the internal audit department that evaluated internal control features for each planned application.
4. Which of the following is the most important factor in planning for a system change?
   a. Having an auditor as a member of the design team.
   b. Using state-of-the-art techniques.
   c. Concentrating on software rather than hardware.
   d. Involving top management and people who use the system.
   e. Selecting a user to lead the design team.
5. In the context of the TELOS acronym, technical feasibility refers to whether
   a. a proposed system is attainable, given the existing technology.
   b. the systems manager can coordinate and control the activities of the systems department.
   c. an adequate computer site exists for the proposed system.
   d. the proposed system will produce economic benefits exceeding its costs.
   e. the system will be used effectively within the operating environment of an organization.
6. Which of the following steps is NOT considered to be part of this systems survey?
   a. Interviews are conducted with operating people and managers.
   b. The complete documentation of the system is obtained and reviewed.
   c. Measures of processing volume are obtained for each operation.
   d. Equipment sold by various computer manufacturers is reviewed in terms of capability, cost, and availability.
   e. Work measurement studies are conducted to determine the time required to complete various tasks or jobs.
7. A systems development approach that starts with broad organizational goals and the types of decisions organizational executives make is called
   a. bottom-up.
   b. network.
   c. top-down.
   d. strategic.
   e. sequential.
8. The TELOS study that determines whether a project can be completed in an acceptable time frame is
   a. a schedule feasibility study.
   b. a time frame feasibility study.
   c. an on-time feasibility study.
   d. an economic completion feasibility study.
   e. a length of contract feasibility study.

9. Which of the following is least likely to be an accountant's role in the SDLC?
   a. user
   b. consultant
   c. auditor
   d. programmer
   e. all of these are likely roles
10. The TELOS acronym is often used for determining the need for system changes. Which of the following types of feasibility studies are elements of TELOS?
    a. legal, environmental, and economic
    b. environmental, operational, and economic
    c. technical, economic, legal, and practical
    d. practical, technical, and operational
    e. technical, operational, and economic
11. What name is given to the time value of money technique that discounts the after-tax cash flows for a project over its life to time period zero using the company's minimum desired rate of return?
    a. net present value method
    b. capital rationing method
    c. payback method
    d. average rate of return method
    e. accounting rate of return method
12. One-time costs of system development include all of the following EXCEPT
    a. site preparation.
    b. hardware maintenance.
    c. programming.
    d. hardware acquisition.
    e. data conversion.
13. Which of the following aspects of a cost-benefit study would have the greatest uncertainty as to its precise value?
    a. the tangible costs
    b. the intangible costs
    c. the tangible benefits
    d. the intangible benefits
    e. none of the above because they are equally precise

Problems

1. Systems Planning

A new systems development project is being planned for Reindeer Christmas Supplies Company. The invoicing, cash receipts, and accounts payable modules are all going to be updated. The controller, Kris K. Ringle, is a little anxious about this project. The last systems development project that affected his department was not very successful, and the employees in the accounting department did not accept the new system very well at first. He feels that the systems personnel did not interact sufficiently with the users of the systems in the accounting department. Prepare a memo from Ringle to the head of the information systems department, Sandy Klaus. In this memo, provide some suggestions for including the accounting personnel in the systems development project. Give persuasive arguments as to why prototyping would be helpful to the workers in the accounting department.

2. Problem Identification

Classify each of the following as a problem or a symptom. If it is a symptom, give two examples of a possible underlying problem. If it is a problem, give two examples of a possible symptom that may be detected.

a. declining profits
b. defective production process
c. low-quality raw materials
d. shortfall in cash balance
e. declining market share
f. shortage of employees in the accounts payable department
g. shortage of raw material due to a drought in the Midwest
h. inadequately trained workers
i. decreasing customer satisfaction

3. Systems Development and User Involvement

Kruger Designs hired a consulting firm three months ago to redesign the information system that the architects use. The architects will be able to use state-of-the-art computer-aided design (CAD) programs to help in designing the products. Further, they will be able to store these designs on a network server where they and other architects may be able to call them back up for future designs with similar components. The consulting firm has been instructed to develop the system without disrupting the architects. In fact, top management believes that the best route is to develop the system and then to introduce it to the architects during a training session. Management does not want the architects to spend precious billable hours guessing about the new system or putting work off until the new system is working. Thus, the consultants are operating in a back room under a shroud of secrecy.

Required:

a. Do you think that management is taking the best course of action for the announcement of the new system? Why?

b. Do you approve of the development process? Why?

4. Systems Analysis

Consider the following dialogue between a systems professional, Joe Pugh, and a manager of a department targeted for a new information system, Lars Meyer:

Pugh: The way to go about the analysis is to first examine the old system, such as reviewing key documents and observing the workers perform their tasks. Then we can determine which aspects are working well and which should be preserved.

Meyer: We have been through these types of projects before and what always ends up happening is that we do not get the new system we are promised; we get a modified version of the old system.

Pugh: Well, I can assure you that will not happen this time. We just want a thorough understanding of what is working well and what is not.

Meyer: I would feel much more comfortable if we first started with a list of our requirements. We should spend some time up-front determining exactly what we want the system to do for my department. Then, you systems people can come in and determine what portions to salvage if you wish. Just don't constrain us to the old system!

Required:

a. Obviously these two workers have different views on how the systems analysis phase should be conducted. Comment on whose position you sympathize with the most.

b. What method would you propose they take? Why?

5. Fact-Gathering Techniques

Your company, Tractors, Inc., is employing the SDLC for its new information system. You have been chosen as a member of the development team because of your strong accounting background. This background includes a good understanding of both financial and managerial accounting concepts and required data. You also possess a great understanding of internal control activities. You do not, however, fully understand exactly what the internal auditors will need from the system in order to comply with Section 404 of the Sarbanes-Oxley Act. Lay out the fact-gathering techniques you might employ to increase your understanding of this important component of your new system.

6. Systems Selection

Your company, Kitchen Works, is employing the SDLC for its new information system. The company is currently performing a number of feasibility studies, including the economic feasibility study. A draft of the economic feasibility study has been presented to you for your review. You have been charged with determining whether only escapable costs have been used, the present value of cash flows is accurate, the one-time and recurring costs are correct, realistic useful lives have been used, and the intangible benefits listed in the study are reasonable. While you are a member of the development team because of your strong accounting background, you have questions about whether some costs are escapable, the interest rates used to perform present value analysis, and the estimated useful lives that have been used. How might you resolve your questions?

7. Cost-Benefit Analysis

Listed on the next page are some probability estimates of the costs and benefits associated with two competing projects.

Problem 7:
Cost-Benefit Analysis

COST OF CAPITAL = .14

	A		**B**	
	Probability	**Amount**	**Probability**	**Amount**
Project completion time	0.5	12 months	0.6	12 months
	0.3	18 months	0.2	18 months
	0.2	24 months	0.1	24 months
Expected useful life	0.6	4 years	0.5	4 years
	0.25	5 years	0.3	5 years
	0.15	6 years	0.2	6 years
One-time costs	0.35	$200,000	0.2	$210,000
	0.4	250,000	0.55	250,000
	0.25	300,000	0.25	260,000
Recurring costs	0.1	$ 75,000	0.4	$ 85,000
	0.55	95,000	0.4	100,000
	0.35	105,000	0.2	110,000
Annual tangible benefits starting with weighted average completion date	0.3	$220,000	0.25	$215,000
	0.5	233,000	0.5	225,000
	0.2	240,000	0.25	235,000

a. Compute the net present value of each alternative. Round the cost projections to the nearest month. Explain what happens to the answer if the probabilities of the recurring costs are incorrect and a more accurate estimate is as follows:

A		B	
.10	$ 75,000	.4	$ 85,000
.55	95,000	.4	100,000
.35	105,000	.2	110,000

b. Repeat step (a) for the payback method.

c. Which method do you feel provides the best source of information? Why?

8. Balanced Scorecard

An organization's IT function has the following goals:

- Improve the quality of IT solutions and services to its internal users.
- Increase the ratio of planned-to-realized benefits from systems solutions.
- Fully match IT strategy with enterprise strategies.
- Integrate information systems architectures to minimize database redundancy and increase systems reusability across the user community.

Required:
Develop a BSC depicting specific measures for each of the four BSC perspectives.

Systems Development Cases

Several systems development cases that draw upon the material in this chapter and Chapter 14 are available online at http://academic.cengage.com