Chapter 14

Project Management: Establishing the Business Value of Systems and Managing Change

LEARNING OBJECTIVES

After reading this chapter, you will be able to:

1. Identify and describe the objectives of project management and why it is so essential in developing information systems.

2. Compare models for selecting and evaluating information systems projects and methods for aligning IS projects with the firm's business goals.

3. Evaluate models for assessing the business value of information systems.

4. Analyze the principal risk factors in information systems projects.

5. Select appropriate strategies for managing project risk and system implementation.

CHAPTER OUTLINE

14.1 THE IMPORTANCE OF PROJECT MANAGEMENT
- Runaway Projects and System Failure
- Project Management Objectives

14.2 SELECTING PROJECTS
- Management Structure for Information Systems Projects
- Linking Systems Projects to the Business Plan
- Enterprise Analysis and Critical Success Factors
- Portfolio Analysis
- Scoring Models

14.3 ESTABLISHING THE BUSINESS VALUE OF INFORMATION SYSTEMS
- Information System Costs and Benefits
- Capital Budgeting for Information Systems
- Case Example: Capital Budgeting for a New Supply Chain Management System
- Real Options Pricing Models
- Limitations of Financial Models

14.4 MANAGING PROJECT RISK
- Dimensions of Project Risk
- Change Management and the Concept of Implementation
- Controlling Risk Factors
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14.5 HANDS-ON MIS
- Improving Decision Making: Using Spreadsheet Software to Analyze the Return on a New System Investment: Dirt Bikes USA
- Improving Decision Making: Using Spreadsheet Software for Capital Budgeting for a New CAD System
- Improving Decision Making: Using Web Tools for Buying and Financing a Home

Interactive Sessions:
- Managing IT in the Merger and Acquisition Game
- Getting Buy-In and ROI from CRM

LEARNING TRACK MODULE
- Information Technology Investments and Productivity
G. Edwards is one of the oldest and largest full-service retail brokerages in the United States, offering securities and commodities brokerage, asset management, trust services, mutual funds, insurance, and investment banking through offices nationwide. It's in a very information-intensive and competitive industry where companies are expected to continually enhance existing systems and bring new systems on board to support new products and services.

When John Parker became A.G. Edwards's chief technology officer (CTO), the company's information technology costs were too high, and information systems projects dragged on for years. Most of these projects cost 54 percent more and took 54 percent longer than original estimates. One to two percent were never completed, and the cost of writing them off took a toll on the company's bottom line. In 2002 alone, the company wrote off $46 million in software investments.

Parker, who had experience with fast-track projects as Northwest Airlines vice president of information services from 1999 to 2001, was charged with turning A.G. Edwards's project management record around. Parker enlisted project management expert Ed Pilewski to implement a “standard plan framework” for monitoring, measuring, and reporting on project progress.

The framework lists 25 high-level activities for managers to track during the course of an information systems project, such as performing requirements analysis and constructing test plans. It also highlights interdependencies between systems, such as new interfaces that might be required for a new system that exchanges data with other systems. The framework also identifies the time each information systems group will work on a specific project each month. Managers have the flexibility to detail the tasks that must be performed within each activity and how they will be carried out.

Software from Primavera provides project managers, planners, and developers with dashboards and progress reports on each project. They can use this tool to compare original estimates with actual costs, determine if milestones have been met, list activities that require completion, or view all projects assigned to a specific information systems group.

But good project management methods and tools are not enough to guarantee success. To be used effectively, they require strong leadership and cooperative relationships between information systems and end user managers.

Parker worked with A.G. Edwards senior executives to identify the most important projects and to provide all IT managers with training to improve confidence and leadership skills. He staged a series of quarterly meetings to teach line managers how to work with budgets, provide vision,
and express opinions honestly yet diplomatically. He asked project managers receptive to new ideas to participate in pilot projects using the standard plan framework and then promote the methodology among their colleagues. He measured project success rates and published the results in quarterly reports to senior management.

It would appear that Parker has succeeded. In 2006, A.G. Edwards's project success rate (measured by the number of projects completed within time and budget that deliver the expected business value) soared to 88 percent. There are no longer any failed projects that must be written off. By managing its IT projects more effectively, the company reduced IT and telecom costs from $295 million in 2002 to $242 million in 2005.


One of the principal challenges posed by information systems is ensuring they can deliver genuine business benefits. There is a very high failure rate among information systems projects because organizations have incorrectly assessed their business value or because firms have failed to manage the organizational change surrounding the introduction of new technology.

John Parker and his team at A.G. Edwards realized this and took special pains to prepare managers and employees for the changes brought about by new systems.

The chapter-opening diagram calls attention to important points raised by this case and this chapter. A.G. Edwards is in an information-intensive industry where it must continually build new systems and enhance existing systems to remain competitive. Its inability to manage its information systems projects raised operating costs and prevented the company from realizing a good
HEADS UP
During your career, you will undoubtedly be asked to work on information systems projects to solve an important challenge for your firm. Whether the project entails building a new information system or enhancing an existing system, you will need to know how to measure the business benefits of these investments, and how to make sure that these systems work successfully in your organization. The success of your project will depend on how well it is managed.

- If your career is in finance and accounting, you will help systems builders use financial models to justify investments in information systems projects.
- If your career is in human resources, you will be working with employees to help them adjust to new job responsibilities, reporting relationships, and other changes associated with new systems.
- If your career is in information systems, you will be evaluating the technology for new system projects and working with project management tools and software to document and monitor project plans.
- If your career is in manufacturing, production or operations management, you will participate in projects to develop or enhance supply chain management systems and enterprise resource planning systems. These systems can provide significant benefits, but they are among the most difficult to implement successfully because they require major changes to the organization as well as new technology.
- If your career is in sales and marketing, you will be working on projects to develop or enhance customer relationship management (CRM) systems. CRM systems provide both tangible and intangible benefits, but are challenging to implement because they typically require extensive business process change.

14.1 THE IMPORTANCE OF PROJECT MANAGEMENT
There is a very high failure rate among information systems projects. In nearly every organization, information systems projects take much more time and money to implement than originally anticipated, or the completed system does not work properly. When an information system fails to work properly or costs too much to develop, companies may not realize any benefit from their information system investment, and the system may not be able to solve the problems for which it was intended. The development of a new system must be carefully managed and orchestrated, and the way a project is executed is likely to be the most important factor influencing its outcome (Wallace and Keil, 2004). That's why it's essential to have some knowledge about how to manage information systems projects and about how and why they succeed or fail.
RUNAWAY PROJECTS AND SYSTEM FAILURE

How badly are projects managed? On average, private sector projects are underestimated by one-half in terms of budget and time required to deliver the complete system promised in the system plan. A very large number of projects are delivered with missing functionality (promised for delivery in later versions). The Standish Group consultancy, which monitors IT project success rates, found that only 29 percent of all technology investments were completed on time, on budget, and with all features and functions originally specified (Levinson, 2006). Between 30 and 40 percent of all software projects are "runaway" projects that far exceed the original schedule and budget projections and fail to perform as originally specified (Keil, Mann, and Rai, 2000).

As illustrated in Figure 14-1, a systems development project without proper management will most likely suffer these consequences:

- Costs that greatly exceed budgets
- Unexpected time slippage
- Technical performance that is less than expected
- Failure to obtain anticipated benefits

The systems produced by failed information projects are often not used in the way they were intended, or they are not used at all. Users often have to develop parallel manual systems to make these systems work.

The actual design of the system may fail to capture essential business requirements or improve organizational performance. Information may not be provided quickly enough to be helpful; it may be in a format that is impossible to digest and use; or it may represent the wrong pieces of data.

The way in which nontechnical business users must interact with the system may be excessively complicated and discouraging. A system may be designed with a poor user interface. The user interface is the part of the system with which end users interact. For example, an online input form or data entry screen may be so poorly arranged that no one wants to submit data or request information. System outputs may be displayed in a format that is too difficult to comprehend (Spier and Morris, 2003).

Web sites may discourage visitors from exploring further if the Web pages are cluttered and poorly arranged, if users cannot easily find the information they are seeking, or if it takes too long to access and display the Web page on the user's computer.

Additionally, the data in the system may have a high level of inaccuracy or inconsistency. The information in certain fields may be erroneous or imprecise.

FIGURE 14-1 CONSEQUENCES OF POOR PROJECT MANAGEMENT

Without proper management, a systems development project takes longer to complete and most often exceeds the allocated budget. The resulting information system most likely is technically inferior and may not be able to demonstrate any benefits to the organization. Great ideas for systems often flounder on the rocks of implementation.
ambiguous, or it may not be organized properly for business purposes. Information required for a specific business function may be inaccessible because the data are incomplete.

**PROJECT MANAGEMENT OBJECTIVES**

A **project** is a planned series of related activities for achieving a specific business objective. Information systems projects include the development of new information systems, enhancing existing systems, or projects for replacing or upgrading the firm's information technology (IT) infrastructure.

**Project management** refers to the application of knowledge, skills, tools, and techniques to achieve specific targets within specified budget and time constraints. Project management activities include planning the work, assessing risk, estimating resources required to accomplish the work, organizing the work, acquiring human and material resources, assigning tasks, directing activities, controlling project execution, reporting progress, and analyzing the results. As in other areas of business, project management for information systems must deal with five major variables: scope, time, cost, quality, and risk.

**Scope** defines what work is or is not included in a project. For example, the scope of a project for a new order processing system might include new modules for inputting orders and transmitting them to production and accounting but not any changes to related accounts receivable, manufacturing, distribution, or inventory control systems. Project management defines all the work required to complete a project successfully, and should ensure that the scope of a project not expand beyond what was originally intended.

**Time** is the amount of time required to complete the project. Project management typically establishes the amount of time required to complete major components of a project. Each of these components is further broken down into activities and tasks. Project management tries to determine the time required to complete each task and establish a schedule for completing the work.

**Cost** is based on the time to complete a project multiplied by the cost of human resources required to complete the project. Information systems project costs also include the cost of hardware, software, and work space. Project management develops a budget for the project and monitors ongoing project expenses.

**Quality** is an indicator of how well the end result of a project satisfies the objectives specified by management. The quality of information systems projects usually boils down to improved organizational performance and decision making. Quality also considers the accuracy and timeliness of information produced by the new system and ease of use.

**Risk** refers to potential problems that would threaten the success of a project. These potential problems might prevent a project from achieving its objectives by increasing time and cost, lowering the quality of project outputs, or preventing the project from being completed altogether. Section 14.4 describes the most important risk factors for information systems.

### 14.2 Selecting Projects

Companies typically are presented with many different projects for solving problems and improving performance. There are far more ideas for systems projects than there are resources. Firms will need to select from this group the
projects that promise the greatest benefit to the business. Obviously the firm’s overall business strategy should drive project selection.

**MANAGEMENT STRUCTURE FOR INFORMATION SYSTEMS PROJECTS**

Figure 14-2 shows the elements of a management structure for information systems projects in a large corporation. It helps ensure that the most important systems projects are given priority.

At the apex of this structure is the corporate strategic planning group and the information system steering committee. The corporate strategic planning group is responsible for developing the firm’s strategic plan, which may require the development of new systems.

The information systems steering committee is the senior management group with responsibility for systems development and operation. It is composed of department heads from both end-user and information systems areas. The steering committee reviews and approves plans for systems in all divisions, seeks to coordinate and integrate systems, and occasionally becomes involved in selecting specific information systems projects.

The project team is supervised by a project management group composed of information systems managers and end-user managers responsible for overseeing several specific information systems projects. The project team is directly responsible for the individual systems project. It consists of systems analysts, specialists from the relevant end-user business areas, application programmers, and perhaps database specialists. The mix of skills and the size of the project team depend on the specific nature of the system solution.

**FIGURE 14-2 MANAGEMENT CONTROL OF SYSTEMS PROJECTS**

Each level of management in the hierarchy is responsible for specific aspects of systems projects, and this structure helps give priority to the most important systems projects for the organization.
LINKING SYSTEMS PROJECTS TO THE BUSINESS PLAN

In order to identify the information systems projects that will deliver the most business value, organizations need to develop an information systems plan that supports their overall business plan and in which strategic systems are incorporated into top-level planning. The plan serves as a road map indicating the direction of systems development (the purpose of the plan), the rationale, the current systems/situation, new developments to consider, the management strategy, the implementation plan, and the budget (see Table 14-1).

The plan contains a statement of corporate goals and specifies how information technology will support the attainment of those goals. The report shows how general goals will be achieved by specific systems projects. It identifies specific target dates and milestones that can be used later to evaluate the plan’s progress in terms of how many objectives were actually attained in the time frame specified in the plan. The plan indicates the key management decisions concerning hardware acquisition; telecommunications; centralization/decentralization of authority, data, and hardware; and required organizational change. Organizational changes are also usually described, including management and employee training requirements; recruiting efforts; changes in business processes; and changes in authority, structure, or management practice.

In order to plan effectively, firms need to inventory and document all of their information system applications and IT infrastructure components. For projects in which benefits involve improved decision making, managers should try to identify the decision improvements which would provide the greatest additional value to the firm. They should then develop a set of metrics to quantify the value of more timely and precise information on the outcome of the decision (see Chapter 12 for more detail on this topic).

ENTERPRISE ANALYSIS AND CRITICAL SUCCESS FACTORS

To develop an effective information systems plan, the organization must have a clear understanding of both its long- and short-term information requirements. Two principal methodologies for establishing the essential information requirements of the organization as a whole are enterprise analysis and critical success factors.

Enterprise Analysis (Business Systems Planning)

Enterprise analysis (also called business systems planning) argues that the firm’s information requirements can be understood only by examining the entire organization in terms of organizational units, functions, processes, and data elements. Enterprise analysis can help identify the key entities and attributes of the organization’s data.

The central method used in the enterprise analysis approach is to take a large sample of managers and ask them how they use information, where they get their information, what their objectives are, how they make decisions, and what their data needs are. The results of this large survey of managers are aggregated into subunits, functions, processes, and data matrices. Data elements are organized into logical application groups—groups of data elements that support related sets of organizational processes.
### TABLE 14-1 INFORMATION SYSTEMS PLAN

1. **Purpose of the Plan**
   - Overview of plan contents
   - Current business organization and future organization
   - Key business processes
   - Management strategy

2. **Strategic Business Plan Rationale**
   - Current situation
   - Current business organization
   - Changing environments
   - Major goals of the business plan
   - Firm’s strategic plan

3. **Current Systems**
   - Major systems supporting business functions and processes
   - Current infrastructure capabilities
     - Hardware
     - Software
     - Database
     - Telecommunications and Internet
   - Difficulties meeting business requirements
   - Anticipated future demands

4. **New Developments**
   - New system projects
     - Project descriptions
     - Business rationale
     - Applications’ role in strategy
   - New infrastructure capabilities required
     - Hardware
     - Software
     - Database
     - Telecommunications and Internet

5. **Management Strategy**
   - Acquisition plans
   - Milestones and timing
   - Organizational realignment
   - Internal reorganization
   - Management controls
   - Major training initiatives
   - Personnel strategy

6. **Implementation Plan**
   - Anticipated difficulties in implementation
   - Progress reports

7. **Budget Requirements**
   - Requirements
   - Potential savings
   - Financing
   - Acquisition cycle
Figure 14-3 is an output of enterprise analysis conducted by the Social Security Administration as part of a massive systems redevelopment effort. It shows what information is required to support a particular process, which processes create the data, and which use them. The shaded boxes in the figure indicate a logical application group. In this case, actuarial estimates, agency plans, and budget data are created in the planning process, suggesting that an information system should be built to support planning.

The weakness of enterprise analysis is that it produces an enormous amount of data that is expensive to collect and difficult to analyze. The questions frequently focus not on management’s critical objectives and where information is needed but rather on what existing information is used. The result is a tendency to automate whatever exists rather than developing entirely new approaches to conducting business.

**FIGURE 14-3 PROCESS/DATA CLASS MATRIX**

This chart depicts which data classes are required to support particular organizational processes and which processes are the creators and users of data.
**Critical Success Factors**

The strategic analysis, or critical success factors, approach argues that an organization's information requirements are determined by a small number of **critical success factors (CSFs)** of managers. If these goals can be attained, success of the firm or organization is assured (Rockart, 1979). CSFs are shaped by the industry, the firm, the manager, and the broader environment. For example, CSFs for the automobile industry might include styling, quality, and cost to meet the goals of increasing market share and raising profits. New information systems should focus on providing information that helps the firm meet these goals.

The principal method used in CSF analysis is personal interviews—three or four—with a number of top managers identifying their goals and the resulting CSFs. These personal CSFs are aggregated to develop a picture of the firm's CSFs. Then systems are built to deliver information on these CSFs. (For the method of developing CSFs in an organization, see Figure 14-4.)

The strength of the CSF method is that it produces less data to analyze than does enterprise analysis. Only top managers are interviewed, and the questions focus on a small number of CSFs rather than requiring a broad inquiry into what information is used in the organization. It is especially suitable for top management and for the development of decision-support systems (DSSs) and executive support systems (ESSs). Unlike enterprise analysis, the CSF method focuses organizational attention on how information should be handled.

The method's primary weakness is that there is no particularly rigorous way in which individual CSFs can be aggregated into a clear company pattern. In addition, interviewees (and interviewers) often become confused when

**FIGURE 14-4 USING CSFS TO DEVELOP SYSTEMS**

The CSF approach relies on interviews with key managers to identify their CSFs. Individual CSFs are aggregated to develop CSFs for the entire firm. Systems can then be built to deliver information on these CSFs.
distinguishing between individual and organizational CSFs. These types of CSFs are not necessarily the same. What may be considered critical to a manager may not be important for the organization as a whole. This method is clearly biased toward top managers, although it could be extended to elicit ideas for promising new systems from lower-level members of the organization (Peffers and Gengler, 2003).

PORTFOLIO ANALYSIS

Once strategic analyses have determined the overall direction of systems development, **portfolio analysis** can be used to evaluate alternative system projects. Portfolio analysis inventories all of the organization’s information systems projects and assets, including infrastructure, outsourcing contracts, and licenses. This portfolio of information systems investments can be described as having a certain profile of risk and benefit to the firm (see Figure 14-5) similar to a financial portfolio.

Each information systems project carries its own set of risks and benefits. (Section 14.4 describes the factors that increase the risks of systems projects.) Firms would try to improve the return on their portfolios of IT assets by balancing the risk and return from their systems investments. Although there is no ideal profile for all firms, information-intensive industries (e.g., finance) should have a few high-risk, high-benefit projects to ensure that they stay current with technology. Firms in non-information-intensive industries should focus on high-benefit, low-risk projects.

Most desirable, of course, are systems with high benefit and low risk. These promise early returns and low risks. Second, high-benefit, high-risk systems should be examined; low-benefit, high-risk systems should be totally avoided; and low-benefit, low-risk systems should be reexamined for the possibility of rebuilding and replacing them with more desirable systems having higher benefits. By using portfolio analysis, management can determine the optimal mix of investment risk and reward for their firms, balancing riskier high-reward projects with safer lower-reward ones. Firms where portfolio analysis is aligned with business strategy have been found to have a superior return on their IT assets, better alignment of information technology investments with business objectives, and better organization-wide coordination of IT investments (Jeffrey and Leliveld, 2004).

**FIGURE 14-5  A SYSTEM PORTFOLIO**

Companies should examine their portfolio of projects in terms of potential benefits and likely risks. Certain kinds of projects should be avoided altogether and others developed rapidly. There is no ideal mix. Companies in different industries have different profiles.
SCORING MODELS

A scoring model is useful for selecting projects where many criteria must be considered. It assigns weights to various features of a system and then calculates the weighted totals. Using Table 14-2, the firm must decide among two alternative enterprise resource planning (ERP) systems. The first column lists the criteria that decision makers will use to evaluate the systems. These criteria are usually the result of lengthy discussions among the decision-making group. Often the most important outcome of a scoring model is not the score but agreement on the criteria used to judge a system.

Table 14-2 shows that this particular company attaches the most importance to capabilities for sales order processing, inventory management, and warehousing. The second column in Table 14-2 lists the weights that decision makers attached to the decision criteria. Columns 3 and 5 show the percentage of requirements for each function that each alternative ERP system can provide. Each vendor’s score can be calculated by multiplying the percentage of requirements met for each function by the weight attached to that function. ERP System B has the highest total score.

As with all “objective” techniques, there are many qualitative judgments involved in using the scoring model. This model requires experts who understand the issues and the technology. It is appropriate to cycle through the

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>WEIGHT</th>
<th>%</th>
<th>ERP SYSTEM A SCORE</th>
<th>%</th>
<th>ERP SYSTEM B SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Order Processing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Online order entry</td>
<td>4</td>
<td>67</td>
<td>268</td>
<td>73</td>
<td>292</td>
</tr>
<tr>
<td>1.2 Online pricing</td>
<td>4</td>
<td>81</td>
<td>324</td>
<td>87</td>
<td>348</td>
</tr>
<tr>
<td>1.3 Inventory check</td>
<td>4</td>
<td>72</td>
<td>288</td>
<td>81</td>
<td>324</td>
</tr>
<tr>
<td>1.4 Customer credit check</td>
<td>3</td>
<td>66</td>
<td>198</td>
<td>59</td>
<td>177</td>
</tr>
<tr>
<td>1.5 Invoicing</td>
<td>4</td>
<td>73</td>
<td>292</td>
<td>82</td>
<td>328</td>
</tr>
<tr>
<td>Total Order Processing</td>
<td></td>
<td></td>
<td>1,370</td>
<td></td>
<td>1,469</td>
</tr>
<tr>
<td>2.0 Inventory Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Production forecasting</td>
<td>3</td>
<td>72</td>
<td>216</td>
<td>76</td>
<td>228</td>
</tr>
<tr>
<td>2.2 Production planning</td>
<td>4</td>
<td>79</td>
<td>316</td>
<td>81</td>
<td>324</td>
</tr>
<tr>
<td>2.3 Inventory control</td>
<td>4</td>
<td>68</td>
<td>272</td>
<td>80</td>
<td>320</td>
</tr>
<tr>
<td>2.4 Reports</td>
<td>3</td>
<td>71</td>
<td>213</td>
<td>69</td>
<td>207</td>
</tr>
<tr>
<td>Total Inventory Management</td>
<td></td>
<td></td>
<td>1,017</td>
<td></td>
<td>1,079</td>
</tr>
<tr>
<td>3.0 Warehousing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Receiving</td>
<td>2</td>
<td>71</td>
<td>142</td>
<td>75</td>
<td>150</td>
</tr>
<tr>
<td>3.2 Picking/packing</td>
<td>3</td>
<td>77</td>
<td>231</td>
<td>82</td>
<td>246</td>
</tr>
<tr>
<td>3.3 Shipping</td>
<td>4</td>
<td>92</td>
<td>368</td>
<td>89</td>
<td>356</td>
</tr>
<tr>
<td>Total Warehousing</td>
<td></td>
<td></td>
<td>741</td>
<td></td>
<td>752</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td>3,128</td>
<td></td>
<td>3,300</td>
</tr>
</tbody>
</table>
scoring model several times, changing the criteria and weights, to see how sensitive the outcome is to reasonable changes in criteria. Scoring models are used most commonly to confirm, to rationalize, and to support decisions, rather than as the final arbiters of system selection.

14.3 **ESTABLISHING THE BUSINESS VALUE OF INFORMATION SYSTEMS**

Even if a system project supports a firm’s strategic goals and meets user information requirements, it needs to be a good investment for the firm. The value of systems from a financial perspective essentially revolves around the issue of return on invested capital. Does a particular information system investment produce sufficient returns to justify its costs?

**INFORMATION SYSTEM COSTS AND BENEFITS**

Table 14-3 lists some of the more common costs and benefits of systems. **Tangible benefits** can be quantified and assigned a monetary value. **Intangible benefits**, such as more efficient customer service or enhanced decision making, cannot be immediately quantified but may lead to quantifiable gains in the long run. Transaction and clerical systems that displace labor and save space always produce more measurable, tangible benefits than management information systems, decision-support systems, and computer-supported collaborative work systems.

Chapter 5 introduced the concept of total cost of ownership (TCO), which is designed to identify and measure the components of information technology expenditures beyond the initial cost of purchasing and installing hardware and software. However, TCO analysis provides only part of the information needed to evaluate an information technology investment because it does not typically deal with benefits, cost categories such as complexity costs, and “soft” and strategic factors discussed later in this section.

**CAPITAL BUDGETING FOR INFORMATION SYSTEMS**

**Capital budgeting** models are one of several techniques used to measure the value of investing in long-term capital investment projects. Firms invest in capital projects to expand production to meet anticipated demand or to modernize production equipment to reduce costs. Firms also invest in capital projects for many noneconomic reasons, such as installing pollution control equipment, converting to a human resources database to meet some government regulations, or satisfying nonmarket public demands. Information systems are considered long-term capital investment projects.

The principal capital budgeting models for evaluating information technology projects are:

- The payback method
- The accounting rate of return on investment (ROI)
- The net present value
- The internal rate of return (IRR)
Capital budgeting methods rely on measures of cash flows into and out of the firm. Capital projects generate cash flows into and out of the firm. The investment cost for information systems projects is an immediate cash outflow caused by expenditures for hardware, software, and labor. In subsequent years, the investment may cause additional cash outflows that will be balanced by cash inflows resulting from the investment. Cash inflows take the form of increased sales of more products (for reasons such as new products, higher quality, or increasing market share) or reduced costs in production and operations. The difference between cash outflows and cash inflows is used for calculating the financial worth of an investment. Once the cash flows have been established, several alternative methods are available for comparing different projects and deciding about the investment.

**TABLE 14-3 COSTS AND BENEFITS OF INFORMATION SYSTEMS**

<table>
<thead>
<tr>
<th>COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
</tr>
<tr>
<td>Telecommunications</td>
</tr>
<tr>
<td>Software</td>
</tr>
<tr>
<td>Services</td>
</tr>
<tr>
<td>Personnel</td>
</tr>
</tbody>
</table>

**Tangible Benefits (Cost Savings)**

- Increased productivity
- Lower operational costs
- Reduced workforce
- Lower computer expenses
- Lower outside vendor costs
- Lower clerical and professional costs
- Reduced rate of growth in expenses
- Reduced facility costs

**Intangible Benefits**

- Improved asset utilization
- Improved resource control
- Improved organizational planning
- Increased organizational flexibility
- More timely information
- More information
- Increased organizational learning
- Legal requirements attained
- Enhanced employee goodwill
- Increased job satisfaction
- Improved decision making
- Improved operations
- Higher client satisfaction
- Better corporate image
CASE EXAMPLE: CAPITAL BUDGETING FOR A NEW SUPPLY CHAIN MANAGEMENT SYSTEM

Let’s look at how financial models would work in a real-world business scenario. Heartland Stores is a general merchandise retail chain operating in eight Midwestern states. It has 5 regional distribution centers, 377 stores, and about 14,000 different products stocked in each store. The company is considering investing in new software and hardware modules to upgrade its existing supply chain management system to help it better manage the purchase and movement of goods from its suppliers to its retail outlets. Too many items in Heartland’s stores are out of stock, even though many of these products are in the company’s distribution center warehouses.

Management believes that the new system would help Heartland Stores reduce the amount of items that it must stock in inventory, and thus its inventory costs, because it would be able to track precisely the status of orders and the flow of items in and out of its distribution centers. The new system would reduce Heartland’s labor costs because the company would not need so many people to manage inventory or to track shipments of goods from suppliers to distribution centers and from distribution centers to retail outlets. Telecommunications costs would be reduced because customer service representatives and shipping and receiving staff would not have to spend so much time on the telephone tracking shipments and orders. Heartland Stores expects the system to reduce transportation costs by providing information to help it consolidate shipments to retail stores and to create more efficient shipping schedules. If the new system project is approved, implementation would commence in January 2007 and the new system would become operational in early January 2008.

The solution builds the existing IT infrastructure at the Heartland Stores but requires the purchase of additional server computers, PCs, database software, and networking technology, along with new supply chain planning and execution software. The solution also calls for new radio-frequency identification technology to track items more easily as they move from suppliers to distribution centers to retail outlets.

Figure 14-6 shows the estimated costs and benefits of the system. The system had an actual investment cost of $11,467,350 in the first year (year 0) and a total cost over six years of $19,017,350. The estimated benefits total $32,500,000 after six years. Was the investment worthwhile? If so, in what sense? Financial models to evaluate the investment are depicted in Figure 14-7.

The Payback Method

The payback method is quite simple: It is a measure of the time required to pay back the initial investment of a project. The payback period is computed as follows:

\[
\text{Original investment} \div \text{Annual net cash inflow} = \text{Number of years to pay back}
\]

In the case of Heartland Stores, it will take more than two years to pay back the initial investment. (Because cash flows are uneven, annual cash inflows are summed until they equal the original investment to arrive at this number.) The payback method is a popular method because of its simplicity and power as an initial screening method. It is especially good for high-risk projects in which the useful life of a project is difficult to determine. If a project pays for itself in two years, then it matters less how long after two years the system lasts.
The weakness of this measure is its virtue: The method ignores the time value of money, the amount of cash flow after the payback period, the disposal value (usually zero with computer systems), and the profitability of the investment.

**Accounting Rate of Return on Investment (ROI)**

Firms make capital investments to earn a satisfactory rate of return. Determining a satisfactory rate of return depends on the cost of borrowing

---

**FIGURE 14-6 COSTS AND BENEFITS OF THE NEW SUPPLY CHAIN MANAGEMENT SYSTEM**

<table>
<thead>
<tr>
<th>Year</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
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<td>2007</td>
<td>2008</td>
<td>2009</td>
<td>2010</td>
<td>2011</td>
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<tr>
<td>3</td>
<td>Costs: Hardware</td>
<td></td>
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<tr>
<td>4</td>
<td>Servers</td>
<td>7 @ 80000</td>
<td>560,000</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>Backup servers</td>
<td>4 @ 80000</td>
<td>320,000</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>6</td>
<td>PCs at loading dock</td>
<td>1 @ 1250</td>
<td>125,000</td>
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<td>7</td>
<td>Radio-frequency devices</td>
<td>1000 @ $1175</td>
<td>1,175,000</td>
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<tr>
<td>8</td>
<td>Storage</td>
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<tr>
<td>9</td>
<td>Network Infrastructure</td>
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<tr>
<td>11</td>
<td>Routers and hubs</td>
<td>300 @ 4100</td>
<td>1,230,000</td>
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<tr>
<td>12</td>
<td>Firewalls</td>
<td>2 @ 6300</td>
<td>12,600</td>
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<tr>
<td>13</td>
<td>Wireless RF network</td>
<td>1,750,000</td>
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<tr>
<td>14</td>
<td>Backup network system</td>
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<tr>
<td>15</td>
<td>Telecom links</td>
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<td>226,000</td>
<td>225,000</td>
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<td>16</td>
<td>Software</td>
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<td>18</td>
<td>Database</td>
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<td>19</td>
<td>Web servers (Apache)</td>
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<tr>
<td>20</td>
<td>Supply chain planning &amp; execution modules</td>
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<td>21</td>
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<td>Business staff</td>
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<td>IS staff</td>
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<td>External consultants</td>
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<tr>
<td>26</td>
<td>Training (end users)</td>
<td>382,000</td>
<td>36,000</td>
<td>36,000</td>
<td>36,000</td>
<td>36,000</td>
<td>36,000</td>
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<tr>
<td>27</td>
<td>Subtotal</td>
<td>11,467,350</td>
<td>995,000</td>
<td>995,000</td>
<td>995,000</td>
<td>995,000</td>
<td>995,000</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>28</td>
<td>Maintenance and Support</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>30</td>
<td>Hardware maintenance &amp; upgrades</td>
<td>240,000</td>
<td>240,000</td>
<td>240,000</td>
<td>240,000</td>
<td>240,000</td>
<td></td>
<td></td>
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<tr>
<td>31</td>
<td>Software maintenance &amp; upgrades</td>
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<tr>
<td>32</td>
<td>Subtotal</td>
<td>515,000</td>
<td>515,000</td>
<td>515,000</td>
<td>515,000</td>
<td>515,000</td>
<td></td>
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</tr>
<tr>
<td>33</td>
<td>Total by Year</td>
<td>11,467,350</td>
<td>1,510,000</td>
<td>1,510,000</td>
<td>1,510,000</td>
<td>1,510,000</td>
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<td></td>
</tr>
<tr>
<td>34</td>
<td>Total Costs</td>
<td>19,017,350</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Benefits</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Reduced labor costs</td>
<td>1,650,000</td>
<td>1,400,000</td>
<td>1,400,000</td>
<td>1,400,000</td>
<td>1,400,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>39</td>
<td>Reduced inventory costs</td>
<td>3,500,000</td>
<td>3,500,000</td>
<td>3,500,000</td>
<td>3,500,000</td>
<td>3,500,000</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>38</td>
<td>Reduced transportation costs</td>
<td>1,300,000</td>
<td>1,300,000</td>
<td>1,300,000</td>
<td>1,300,000</td>
<td>1,300,000</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>40</td>
<td>Reduced telecommunications costs</td>
<td>250,000</td>
<td>250,000</td>
<td>250,000</td>
<td>250,000</td>
<td>250,000</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>42</td>
<td>Subtotal</td>
<td>0</td>
<td>6,700,000</td>
<td>8,450,000</td>
<td>8,450,000</td>
<td>8,450,000</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>44</td>
<td>Net Cash Flow</td>
<td>4,000,000</td>
<td>4,940,000</td>
<td>4,940,000</td>
<td>4,940,000</td>
<td>4,940,000</td>
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<td></td>
</tr>
<tr>
<td>46</td>
<td>Total Benefits</td>
<td>32,500,000</td>
<td></td>
<td></td>
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</tbody>
</table>

This spreadsheet analyzes the basic costs and benefits of implementing supply chain management system enhancements for a midsize midwestern U.S. retailer. The costs for hardware, telecommunications, software, services, and personnel are analyzed over a six-year period.
money, but other factors can enter into the equation. Such factors include the historic rates of return expected by the firm. In the long run, the desired rate of return must equal or exceed the cost of capital in the marketplace. Otherwise, no one will lend the firm money.

The **accounting rate of return on investment (ROI)** calculates the rate of return from an investment by adjusting the cash inflows produced by the investment for depreciation. It gives an approximation of the accounting income earned by the project.

To find the ROI, first calculate the average net benefit. The formula for the average net benefit is as follows:

\[
\frac{\text{Total benefits} - \text{Total cost} - \text{Depreciation}}{\text{Useful life}} = \text{Net benefit}
\]

This net benefit is divided by the total initial investment to arrive at ROI. The formula is as follows:

\[
\frac{\text{Net benefit}}{\text{Total initial investment}} = \text{ROI}
\]

In the case of Heartland Stores, the average rate of return on the investment is 2.93 percent.
The weakness of ROI is that it can ignore the time value of money. Future savings are simply not worth as much in today's dollars as are current savings. However, ROI can be modified (and usually is) so that future benefits and costs are calculated in today's dollars. (The present value function on most spreadsheets can perform this conversion.)

**Net Present Value**
Evaluating a capital project requires that the cost of an investment (a cash outflow usually in year 0) be compared with the net cash inflows that occur many years later. But these two kinds of cash flows are not directly comparable because of the time value of money. Money you have been promised to receive three, four, and five years from now is not worth as much as money received today. Money received in the future has to be discounted by some appropriate percentage rate—usually the prevailing interest rate, or sometimes the cost of capital. **Present value** is the value in current dollars of a payment or stream of payments to be received in the future. It can be calculated by using the following formula:

\[
\text{Present value} = \text{Payment} \times \frac{1 - (1 + \text{interest})^n}{\text{Interest}}
\]

Thus, to compare the investment (made in today's dollars) with future savings or earnings, you need to discount the earnings to their present value and then calculate the net present value of the investment. The **net present value** is the amount of money an investment is worth, taking into account its cost, earnings, and the time value of money. The formula for net present value is this:

\[
\text{Net present value} = \text{Present value of expected cash flows} - \text{Initial investment cost}
\]

In the case of Heartland Stores, the present value of the stream of benefits is $21,625,709, and the cost (in today's dollars) is $11,467,350, giving a net present value of $10,158,359. In other words, for a $21 million investment today, the firm will receive more than $10 million. This is a fairly good rate of return on an investment.

**Internal Rate of Return (IRR)**
**Internal rate of return (IRR)** is defined as the rate of return or profit that an investment is expected to earn, taking into account the time value of money. IRR is the discount (interest) rate that will equate the present value of the project's future cash flows to the initial cost of the project (defined here as negative cash flow in year 0 of $11,467,350). In other words, the value of R (discount rate) is such that Present value - Initial cost = 0. In the case of Heartland Stores, the IRR is 33 percent.

**Results of the Capital Budgeting Analysis**
Using methods that take into account the time value of money, the Heartland Stores project is cash-flow positive over the time period under consideration and returns more benefits than it costs. Against this analysis, you might ask what other investments would be better from an efficiency and effectiveness standpoint and if all the benefits have been calculated.
REAL OPTIONS PRICING MODELS

Some information systems projects are highly uncertain, especially investments in IT infrastructure. Their future revenue streams are unclear and their up-front costs are high. Suppose, for instance, that a firm is considering a $20 million investment to upgrade its information technology infrastructure—its hardware, software, data management tools, and networking technology. If this upgraded infrastructure were available, the organization would have the technology capabilities to respond more easily to future problems and opportunities. Although the costs of this investment can be calculated, not all of the benefits of making this investment can be established in advance. But if the firm waits a few years until the revenue potential becomes more obvious, it might be too late to make the infrastructure investment. In such cases, managers might benefit from using real options pricing models to evaluate information technology investments.

Real options pricing models (ROPMs) use the concept of options valuation borrowed from the financial industry. An option is essentially the right, but not the obligation, to act at some future date. A typical call option, for instance, is a financial option in which a person buys the right (but not the obligation) to purchase an underlying asset (usually a stock) at a fixed price (strike price) on or before a given date.

For instance, on June 5, 2006, for $8.70 you could purchase the right (a call option) maturing in January 2008 to buy a share of Procter & Gamble (P&G) common stock for $50 per share. If, by the end of January 2008, the price of P&G stock did not rise above $50 per share, you would not exercise the option, and the value of the option would fall to zero on the strike date. If, however, the price of Procter & Gamble common stock rose to, say, $100 per share, you could purchase the stock for the strike price of $50 and retain the profit of $50 per share minus the cost of the option. (Because the option is sold as a 100-share contract, the cost of the contract would be $870, and you would be purchasing and obtaining a profit from 100 shares of Procter & Gamble.) The stock option enables the owner to benefit from the upside potential of an opportunity while limiting the downside risk.

ROPMs value information systems projects similar to stock options, where an initial expenditure on technology creates the right, but not the obligation, to obtain the benefits associated with further development and deployment of the technology as long as management has the freedom to cancel, defer, restart, or expand the project. ROPMs give managers the flexibility to stage their IT investment or test the waters with small pilot projects or prototypes to gain more knowledge about the risks of a project before investing in the entire implementation. The disadvantages of this model are primarily in estimating all the key variables affecting option value, including anticipated cash flows from the underlying asset and changes in the cost of implementation. Models for determining option value of information technology platforms are being developed (Fichman, 2004; McGrath and MacMillan, 2000).

LIMITATIONS OF FINANCIAL MODELS

The traditional focus on the financial and technical aspects of an information system tends to overlook the social and organizational dimensions of information systems that may affect the true costs and benefits of the investment. Many companies’ information systems investment decisions do not adequately consider costs from organizational disruptions created by a new system, such
as the cost to train end users, the impact that users’ learning curves for a new system have on productivity, or the time managers need to spend overseeing new system-related changes. Benefits, such as more timely decisions from a new system or enhanced employee learning and expertise, may also be overlooked in a traditional financial analysis (Ryan, Harrison, and Schkade, 2002).

14.4 MANAGING PROJECT RISK

We have already introduced the topic of information system risks and risk assessment in Chapter 8. In this chapter, we describe the specific risks to information systems projects and show what can be done to manage them effectively.

DIMENSIONS OF PROJECT RISK

Systems differ dramatically in their size, scope, level of complexity, and organizational and technical components. Some systems development projects are more likely to create the problems we have described earlier or to suffer delays because they carry a much higher level of risk than others. The level of project risk is influenced by project size, project structure, and the level of technical expertise of the information systems staff and project team.

- **Project size.** The larger the project—as indicated by the dollars spent, the size of the implementation staff, the time allocated for implementation, and the number of organizational units affected—the greater the risk. Very large-scale systems projects have a failure rate that is 50 to 75 percent higher than that for other projects because such projects are complex and difficult to control. The organizational complexity of the system—how many units and groups use it and how much it influences business processes—contribute to the complexity of large-scale systems projects just as much as technical characteristics, such as the number of lines of program code, length of project, and budget (Xia and Lee, 2004; Concours Group, 2000; Laudon, 1989). In addition, there are few reliable techniques for estimating the time and cost to develop large-scale information systems.

- **Project structure.** Some projects are more highly structured than others. Their requirements are clear and straightforward so outputs and processes can be easily defined. Users know exactly what they want and what the system should do; there is almost no possibility of the users changing their minds. Such projects run a much lower risk than those with relatively undefined, fluid, and constantly changing requirements; with outputs that cannot be fixed easily because they are subject to users’ changing ideas; or with users who cannot agree on what they want.

- **Experience with technology.** The project risk rises if the project team and the information system staff lack the required technical expertise. If the team is unfamiliar with the hardware, system software, application software, or database management system proposed for the project, it is highly likely that the project will experience technical problems or take more time to complete because of the need to master new skills.

Although the difficulty of the technology is one risk factor in information systems projects, the other factors are primarily organizational, dealing with the complexity of information requirements, the scope of the project, and how many parts of the organization will be affected by a new information system.
CHANGE MANAGEMENT AND THE CONCEPT OF IMPLEMENTATION

The introduction or alteration of an information system has a powerful behavioral and organizational impact. Changes in the way that information is defined, accessed, and used to manage the organization's resources often lead to new distributions of authority and power. This internal organizational change breeds resistance and opposition and can lead to the demise of an otherwise good system.

A very large percentage of information systems projects stumble because the process of organizational change surrounding system building was not properly addressed. Successful system building requires careful change management.

The Concept of Implementation

To manage the organizational change surrounding the introduction of a new information system effectively, you must examine the process of implementation. Implementation refers to all organizational activities working toward the adoption, management, and routinization of an innovation, such as a new information system. In the implementation process, the systems analyst is a change agent. The analyst not only develops technical solutions but also redefines the configurations, interactions, job activities, and power relationships of various organizational groups. The analyst is the catalyst for the entire change process and is responsible for ensuring that all parties involved accept the changes created by a new system. The change agent communicates with users, mediates between competing interest groups, and ensures that the organizational adjustment to such changes is complete.

The Role of End Users

System implementation generally benefits from high levels of user involvement and management support. User participation in the design and operation of information systems has several positive results. First, if users are heavily involved in systems design, they have more opportunities to mold the system according to their priorities and business requirements, and more opportunities to control the outcome. Second, they are more likely to react positively to the completed system because they have been active participants in the change process. Incorporating user knowledge and expertise leads to better solutions.

The relationship between users and information systems specialists has traditionally been a problem area for information systems implementation efforts. Users and information systems specialists tend to have different backgrounds, interests, and priorities. This is referred to as the user-designer communications gap. These differences lead to divergent organizational loyalties, approaches to problem solving, and vocabularies.

Information systems specialists, for example, often have a highly technical, or machine, orientation to problem solving. They look for elegant and sophisticated technical solutions in which hardware and software efficiency is optimized at the expense of ease of use or organizational effectiveness. Users prefer systems that are oriented toward solving business problems or facilitating organizational tasks. Often the orientations of both groups are so at odds that they appear to speak in different tongues.

These differences are illustrated in Table 14-4 which depicts the typical concerns of end users and technical specialists (information systems designers) regarding the development of a new information system. Communication problems between end users and designers are a major reason why user
requirements are not properly incorporated into information systems and why users are driven out of the implementation process.

Systems development projects run a very high risk of failure when there is a pronounced gap between users and technical specialists and when these groups continue to pursue different goals. Under such conditions, users are often driven out of the implementation process. Because they cannot comprehend what the technicians are saying, users conclude that the entire project is best left in the hands of the information specialists alone.

**Management Support and Commitment**

If an information systems project has the backing and commitment of management at various levels, it is more likely to be perceived positively by both users and the technical information services staff. Both groups will believe that their participation in the development process will receive higher-level attention and priority. They will be recognized and rewarded for the time and effort they devote to implementation. Management backing also ensures that a systems project receives sufficient funding and resources to be successful. Furthermore, to be enforced effectively, all the changes in work habits and procedures and any organizational realignments associated with a new system depend on management backing. If a manager considers a new system a priority, the system will more likely be treated that way by his or her subordinates.

**Change Management Challenges for Business Process Reengineering, Enterprise Applications, and Mergers and Acquisitions**

Given the challenges of innovation and implementation, it is not surprising to find a very high failure rate among enterprise application and business process reengineering (BPR) projects, which typically require extensive organizational change and which may require replacing old technologies and legacy systems that are deeply rooted in many interrelated business processes. A number of studies have indicated that 70 percent of all business process reengineering projects fail to deliver promised benefits. Likewise, a high percentage of enterprise applications fail to be fully implemented or to meet the goals of their users even after three years of work.

Many enterprise application and reengineering projects have been undermined by poor implementation and change management practices that failed to address employees’ concerns about change. Dealing with fear and anxiety throughout the organization; overcoming resistance by key managers; changing job functions, career paths, and recruitment practices; and training have posed greater threats to reengineering than the difficulties companies faced visualizing and designing breakthrough changes to business processes. All of

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**TABLE 14-4 THE USER-DESIGNER COMMUNICATIONS GAP**

<table>
<thead>
<tr>
<th>USER CONCERNS</th>
<th>DESIGNER CONCERNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will the system deliver the information I need for my work?</td>
<td>How much disk storage space will the master file consume?</td>
</tr>
<tr>
<td>How quickly can I access the data?</td>
<td>How many lines of program code will it take to perform this function?</td>
</tr>
<tr>
<td>How easily can I retrieve the data?</td>
<td>How can we cut down on CPU time when we run the system?</td>
</tr>
<tr>
<td>How much clerical support will I need to enter data into the system?</td>
<td>What is the most efficient way of storing these data?</td>
</tr>
<tr>
<td>How will the operation of the system fit into my daily business schedule?</td>
<td>What database management system should we use?</td>
</tr>
</tbody>
</table>
the enterprise applications require tighter coordination among different functional groups as well as extensive business process change (see Chapter 9). Projects related to mergers and acquisitions have a similar failure rate. Mergers and acquisitions are deeply affected by the organizational characteristics of the merging companies as well as by their IT infrastructures. Combining the information systems of two different companies usually requires considerable organizational change and complex systems projects to manage. If the integration is not properly managed, firms can emerge with a tangled hodgepodge of inherited legacy systems built by aggregating the systems of one firm after another. Without a successful systems integration, the benefits anticipated from the merger cannot be realized, or, worse, the merged entity cannot execute its business processes and loses customers. The Interactive Session on Management on explores this topic.

**CONTROLLING RISK FACTORS**

Various project management, requirements gathering, and planning methodologies have been developed for specific categories of implementation problems. Strategies have also been devised for ensuring that users play appropriate roles throughout the implementation period and for managing the organizational change process. Not all aspects of the implementation process can be easily controlled or planned. However, anticipating potential implementation problems and applying appropriate corrective strategies can increase the chances for system project success.

The first step in managing project risk involves identifying the nature and level of risk confronting the project (Schmidt, Lyytinen, Keil, and Cule, 2001). Implementers can then handle each project with the tools and risk-management approaches geared to its level of risk (Iversen, Mathiassen, and Nielsen, 2004; Barki, Rivard, and Talbot, 2001; McFarlan, 1981).

**Managing Technical Complexity**

Projects with challenging and complex technology to master benefit from internal integration tools. The success of such projects depends on how well their technical complexity can be managed. Project leaders need both heavy technical and administrative experience. They must be able to anticipate problems and develop smooth working relationships among a predominantly technical team. The team should be under the leadership of a manager with a strong technical and project management background and team members should be highly experienced. Team meetings should take place frequently. Essential technical skills or expertise not available internally should be secured from outside the organization.

**Formal Planning and Control Tools**

Large projects benefit from appropriate use of formal planning tools and formal control tools for documenting and monitoring project plans. The two most commonly used methods for documenting project plans are Gantt charts and PERT charts. A Gantt chart lists project activities and their corresponding start and completion dates. The Gantt chart visually represents the timing and duration of different tasks in a development project as well as their human resource requirements (see Figure 14-8). It shows each task as a horizontal bar whose length is proportional to the time required to complete it.
In 2005, there were 7,736 mergers and acquisitions in the United States, and the average value of M&As has risen to a record $385.6 million in the first half of 2006. "Due diligence" is the concept used to describe what acquirers should perform before they make an acquisition. Technically, for public firms, due diligence is a legal requirement of senior management to ensure the financial and business statements of firms they are acquiring are accurate and complete.

In the past, acquiring firms have lost a great deal of money by ignoring a very important element of the acquired firm’s business, namely, its information systems. Because M&As are typically entered into for financial reasons (greater market share, elimination of competitors, greater efficiency and profitability), and are led by financial managers, it is understandable that sizing up the target company’s IT infrastructure is last on the list of due diligence activities.

But there is a price to pay for ignoring the IT/IS element in mergers. When Wells Fargo purchased its rival First Interstate, it created an IT nightmare. Wells Fargo closed down the First Interstate branches and ATMs, costing the bank over $100 million as 20 percent of First Interstate customers closed their accounts.

There are a number of systems-related risks in M&As. The target company may have stopped spending on maintenance years ago to decrease costs and increase profits. It may have fallen behind competitors in new applications. Its software licenses may not be transferable to the new company without significant new fees. The infrastructure may be outdated. The target company’s systems may be totally incompatible with the acquirer’s systems. One important reason Logicalis, an IT integration and consulting company, backed off acquiring a value-added reseller was that the company’s CRM system was incompatible with its own.

So how do companies perform due diligence in the information systems area? What are some management tactics for dealing with the merger of two or more very different IT infrastructures? The first step is to classify the assets your firm is about to acquire, create an inventory of these assets, and establish the value of these systems to the newly merged firm. For instance, you could divide the target firm’s IT assets into four categories:

- Transactional systems that perform the basic transactions of the firm;
- Informational systems that inform management about the state of operations;
- Strategic systems that differentiate the firm in the marketplace; and
- Basic infrastructure that includes both the hardware and software installed, as well as the services provided by the IS group to the business.

Once you have created an inventory of the target firm’s IT assets, you will need to value their potential contribution to the new firm. There are four options:

- Keep the target company systems if they are better than your own;
- Keep your own systems and retire the target company systems if yours are better;
- Choose the best of both companies’ systems; or
- Use the M&A to build an entirely new infrastructure.

In general, firms rarely decided to build a new infrastructure completely. Most commonly, the acquiring firms shut down systems of the acquired company and extend the reach of their own systems. Target firms are usually smaller and less capitalized than acquiring firms and have systems that lag behind those of the acquiring firm. Moreover, the financial rationale for many mergers is scale economies. The argument is that the existing IT/IS infrastructure of the acquiring firm can be expanded with minimal cost, while the merged companies’ revenues will increase many fold. The same fixed costs in infrastructure will be able to support a much larger and more profitable business.

But the evidence that managers at acquiring firms really understand the risks of mergers and acquisitions is not encouraging. Studies of M&A activity over the past 75 years show that about 60 percent actually destroy shareholder value and result in falling stock prices for the acquiring company. The reasons are that the acquiring firm overvalues the assets of the target firm and systematically underestimate the risks of the acquisition, especially the costs of merging the operational activities and information system infrastructures of two firms.

CASE STUDY QUESTIONS

1. What are some of the risks involved when one firm acquires another firm’s IT infrastructure?
2. Why do firms often fail to take the target firm’s information systems and IT infrastructure into account when purchasing other firms?
3. How would you go about assessing the value of another firm’s IT infrastructure and operational capabilities? What questions would you ask?

MIS IN ACTION

1. Bain and Company is one of the premiere business consulting firms specializing in advice about mergers and acquisitions. Visit www.Bain.com and explore the advice on how to conduct a successful merger by clicking on the “Consulting Expertise” tab, and then selecting “Mergers & Acquisitions.” Read this page, then click on “Deals Done Right.” Why does Bain advise managers to stay close to their “core business?” Why might this advice ease the change in information systems infrastructure when mergers take place? What does Bain recommend about “integration” of the business and how would this affect IS/IT decisions?

2. On the Web, explore the IT/IS integration issues raised by one of these mega mergers of the past few years: Proctor & Gamble/Gillette; UJF/Mitsubishi Tokyo Financial, HEXAL/Novartis, or Kellogg/Keebler. You can explore these mergers using Google searches such as “Kellogg Keebler merger.”
The Gantt chart in this figure shows the task, person-days, and initials of each responsible person, as well as the start and finish dates for each task. The resource summary provides a manager with the total person-days for each month and for each person working on the project to manage the project successfully. The project described here is a data administration project.
Although Gantt charts show when project activities begin and end, they don't depict task dependencies, how one task is affected if another is behind schedule, or how tasks should be ordered. That is where **PERT charts** are useful. PERT stands for Program Evaluation and Review Technique, a methodology developed by the U.S. Navy during the 1950s to manage the Polaris submarine missile program. A PERT chart graphically depicts project tasks and their interrelationships. The PERT chart lists the specific activities that make up a project and the activities that must be completed before a specific activity can start, as illustrated in Figure 14-9.

The PERT chart portrays a project as a network diagram consisting of numbered nodes (either circles or rectangles) representing project tasks. Each node is numbered and shows the task, its duration, the starting date, and the completion date. The direction of the arrows on the lines indicates the sequence of tasks and shows which activities must be completed before the commencement of another activity. In Figure 14-9, the tasks in nodes 2, 3, and 4 are not dependent on each other and can be undertaken simultaneously, but each is dependent on completion of the first task. PERT charts for complex projects can be difficult to interpret, and project managers often use both techniques.

These project management techniques can help managers identify bottlenecks and determine the impact that problems will have on project completion times. They can also help systems developers partition projects
into smaller, more manageable segments with defined, measurable business results. Standard control techniques can successfully chart the progress of the project against budgets and target dates, so deviations from the plan can be spotted.

**Increasing User Involvement and Overcoming User Resistance**

Projects with relatively little structure and many undefined requirements must involve users fully at all stages. Users must be mobilized to support one of many possible design options and to remain committed to a single design. **External integration tools** consist of ways to link the work of the implementation team to users at all organizational levels. For instance, users can become active members of the project team, take on leadership roles, and take charge of installation and training. The implementation team can demonstrate its responsiveness to users, promptly answering questions, incorporating user feedback, and showing their willingness to help (Gefen and Ridings, 2002).

Participation in implementation activities may not be enough to overcome the problem of user resistance to organizational change. Different users may be affected by the system in different ways. Whereas some users may welcome a new system because it brings changes they perceive as beneficial to them, others may resist these changes because they believe the shifts are detrimental to their interests.

If the use of a system is voluntary, users may choose to avoid it; if use is mandatory, resistance will take the form of increased error rates, disruptions, turnover, and even sabotage. Therefore, the implementation strategy must not only encourage user participation and involvement, but it must also address the issue of counterimplementation (Keen, 1981). **Counterimplementation** is a deliberate strategy to thwart the implementation of an information system or an innovation in an organization.

Strategies to overcome user resistance include user participation (to elicit commitment as well as to improve design), user education and training, management edicts and policies, and better incentives for users who cooperate. The new system can be made more user friendly by improving the end-user interface. Users will be more cooperative if organizational problems are solved prior to introducing the new system.

The Interactive Session on Organizations illustrates how one company used these techniques to build user support for a new customer relationship management system (CRM). CRM system projects often encounter user resistance because they typically require marketing and sales staff to share information and change the way they work.

**DESIGNING FOR THE ORGANIZATION**

Because the purpose of a new system is to improve the organization's performance, information systems projects must explicitly address the ways in which the organization will change when the new system is installed, including installation of intranets, extranets, and Web applications. In addition to procedural changes, transformations in job functions, organizational structure, power relationships, and the work environment should be carefully planned.

Areas where users interface with the system require special attention, with sensitivity to ergonomics issues. **Ergonomics** refers to the interaction of people and machines in the work environment. It considers the design of jobs, health
The idea behind customer relationship management (CRM) seems simple enough: to centralize and share throughout the firm information about customers in order to maximize sales and profitability. For a variety of reasons—most having to do with implementation issues—achieving these objectives proves difficult.

Consider the case of Wallace, Welch & Willingham (WWW), a Florida-based insurance company. The firm decided to purchase a contemporary CRM system after its existing patchwork of file cards, rolodexes, and accounting packages failed to produce a coherent view of the customer. The job of implementing went to the IT Director, Kirstin Johnson. The firm has two lines of business: commercial and residential insurance, and a 20-person sales force. Each of the sales reps kept their own customer information on index cards, and sale information was stored on their personal spreadsheets and then uploaded to an accounting application when sales were finally booked and payments received. There was no ability to share information. Sales reps were paid on commission and received a percentage of the annual insurance revenue.

When sales people left the firm, they took the customer information with them, or just left it in their desks. The sales manager would assign a few sale reps to search through the empty desks of departed employees to find potential “workable leads.”

In the search for a vendor, Johnson faced two barriers: finding the right vendor, and understanding the costs before committing to a single vendor. She spent several weeks interviewing CRM users in other firms to identify which vendors were most respected. Cost was another matter: it was painfully difficult to figure out how much licensing a system would really cost in day-to-day use. There were per-seat models, pay-for-use models, and hosted “on-demand” solutions where you paid by the month depending on how much your sales force used the system. She finally went with the “on demand” solution because it did not involve installing any new software or hardware at WWW, and seemed the least expensive way to go. The main vendors were Sage CRM SalesLogix and salesforce.com. Ultimately, she chose SalesLogix because it allowed her a choice: she could start with an on-demand, online model and then later install the system on in-house servers if that became less expensive and more suitable.

Getting buy-in from the sales force was the most difficult barrier to implementation. For starters, she shut down the ability of sales people to use the accounting system for entering customer information, and forced them to enter customer data and establish files for all their customers on the SalesLogix system. If sales people did not file their customer prospecting information on the new system, it was assumed they were not doing their jobs, and this would show up in bi-annual performance reviews. Her logic was “if there’s no driving force behind using the system, people can just ignore it.”

Staff resistance sprung up immediately. Sales reps worried their information would be lost on another firm’s Web site; they felt the system could not handle all the information they wanted to put in it; many felt the system would “blow up” someday if SalesLogix went out of business, or was purchased by another firm. The firm’s largest revenue producing sales rep refused to use the new system. Instead, he printed out customer notes using a word processor and distributed them to other sales reps. He created his own manual paper-based CRM! When other reps saw this, they asked “Why should I use the new system?” Everyone wanted to continue doing their own thing.

Recognizing that sales reps don’t like to take orders from the IT department, and that sales reps in many firms are the major producers of revenue that no one wants to disturb, Johnson called out to the sales manager for help. The sales manager was sympathetic, and told the recalcitrant user to either use the SalesLogix system or face severe consequences. After that, the leading revenue-producing sales rep started using the system, and in fact became its champion supporter.

After a year of training, educating, and cajoling, the implementation effort finally achieved its ambition of centralizing customer information, and creating a platform where the information could be shared, and where it was protected from high turnover in the sales force. Customer information was, for the first time, information that belonged to the firm, not the sales reps. This in itself was quite a revolution.
1. Why was the director of IT assigned the job of implementing a CRM system? Would this job be better performed by the sales manager?

2. Why were sales reps reluctant to share customer information with other sales reps? What strategies did Kirstin Johnson use to overcome user resistance? How would you recommend the firm overcome this problem?

3. What do you think the metrics for CRM success should be in a firm like this? How would you change the sales rep compensation plan to support more effective use of the CRM system?

CASE STUDY QUESTIONS

1. Go to the Sage CRM SalesLogix Web site at www.saleslogix.com. Explore the product description for SalesLogix. What kinds of firms is this product aimed at? What kinds of functionality is provided in the suite of SalesLogix programs? What is the advantage of a hosted solution versus an on-demand solution?

2. At the SalesLogix Web site, explore the company’s mobile solutions by playing the mobile solution Flash demo. How could firms take advantage of SalesLogix mobile solutions? What are some of the risks of a mobile solution?

3. On the SalesLogix Web site, identify and review a success case study (usually displayed on the home page). What are the major themes emphasized in the case?

MIS IN ACTION

issues, and the end-user interface of information systems. Table 14-5 lists the organizational dimensions that must be addressed when planning and implementing information systems.

Although systems analysis and design activities are supposed to include an organizational impact analysis, this area has traditionally been neglected. An organizational impact analysis explains how a proposed system will affect organizational structure, attitudes, decision making, and operations. To integrate information systems successfully with the organization, thorough and fully documented organizational impact assessments must be given more attention in the development effort.
Sociotechnical Design
One way of addressing human and organizational issues is to incorporate sociotechnical design practices into information systems projects. Designers set forth separate sets of technical and social design solutions. The social design plans explore different workgroup structures, allocation of tasks, and the design of individual jobs. The proposed technical solutions are compared with the proposed social solutions. The solution that best meets both social and technical objectives is selected for the final design. The resulting sociotechnical design is expected to produce an information system that blends technical efficiency with sensitivity to organizational and human needs, leading to higher job satisfaction and productivity.

PROJECT MANAGEMENT SOFTWARE TOOLS
Commercial software tools that automate many aspects of project management facilitate the project management process. Project management software typically features capabilities for defining and ordering tasks, assigning resources to tasks, establishing starting and ending dates to tasks, tracking progress, and facilitating modifications to tasks and resources. Many automate the creation of Gantt and PERT charts.

Some of these tools are large, sophisticated programs for managing very large projects, dispersed work groups, and enterprise functions. These high-end tools can manage very large numbers of tasks and activities and complex relationships.

Microsoft Project has become the most widely used project management software today. It is PC-based, with capabilities for producing PERT and Gantt charts and for supporting critical path analysis, resource allocation, project tracking, and status reporting. Project Guide wizards are available to assist users in defining a project, listing tasks, setting deadlines, specifying workers and associated costs, choosing calendar templates, and saving a baseline version of the project plan. Project also tracks the way changes in one aspect of a project affect others.

Microsoft Project now has an Enterprise Project Management Solution version with a server component that helps large enterprises manage projects in many different locations. Project also provides a Web-based front end so that users can work with Web browser software to add project resources. Products such as EasyProjects.NET and Vertabase are also useful for firms that want Web-based project management tools.
14.5 Hands-on MIS

The projects in this section give you hands-on experience using spreadsheet software to perform capital budgeting analyses for new information systems investments and using Web tools to analyze the financing for a new home.

Improving Decision Making: Using Spreadsheet Software to Analyze the Return on a New System Investment

Software skills: Spreadsheet formulas and functions  
Business skills: Capital budgeting

This project provides you with an opportunity to use spreadsheet software to use the capital budgeting models discussed in this chapter to analyze the return on a new information system investment for a real-world company.

Dirt Bikes’s management would like to analyze the return on its investment in its employee training and skills tracking system described in Chapter 13. The system runs on the human resources specialists’ PCs using PC database software. Because the entire corporate administrative staff recently received new desktop PC systems with database and other productivity software, there are no additional hardware and software purchase costs. The main costs include the initial cost of designing and implementing the database (business staff cost of $5,000; information systems staff cost of $15,000), gathering and adding employee skills and training data to the database ($5,500 initial data conversion cost plus $1,000 annual data entry costs), and ongoing maintenance and support ($3,000 annually). Human resources staff members believe the new application could save each of them two hours of work per week. (Their annual salaries are $37,000 and $42,000 each.) The company would also save about $11,000 annually in employee recruiting costs because it would be able to fill many vacant positions with existing employees, thereby reducing its costs for recruiting outside the company. The system would not be installed until the end of 2007 and would return benefits from 2008 to 2012.

• Prepare a report for management analyzing the return on the investment for this system over a five-year period using the following capital budgeting models: net present value, ROI, IRR, and payback method. Assume a 5 percent interest rate for your net present value calculations. Use spreadsheet software for your calculations.

• (Optional) Use electronic presentation software to summarize your findings for management.

Improving Decision Making: Using Spreadsheet Software for Capital Budgeting for a New CAD System

Software skills: Spreadsheet formulas and functions  
Business skills: Capital budgeting

This project provides you with an opportunity to use spreadsheet software to use the capital budgeting models discussed in this chapter to analyze the return on an investment for a new computer-aided design (CAD) system.

Your company would like to invest in a new CAD system that requires purchasing hardware, software, and networking technology, as well as expenditures for installation, training, and support. The Laudon Web site for Chapter 14 and Student CD-ROM contain tables showing each cost component for the new CAD system. Your management team is interested in analyzing the return on this investment over a five-year period. Assume 5 percent interest rates for your calculations.

• Prepare a report analyzing the return on the investment for this system using the following capital budgeting models: net present value, ROI, IRR, and payback method. Assume a 5 percent interest rate for your net present value calculations. Use spreadsheet software for your calculations.

• (Optional) Use electronic presentation software to summarize your findings for management.
system as well as annual maintenance costs over a five-year period. You believe the new system will produce annual savings by reducing the amount of labor required to generate designs and design specifications, thus increasing your firm’s annual cash flow.

- Using the data provided in these tables, create a worksheet that calculates the costs and benefits of the investment over a five-year period and analyzes the investment using the four capital budgeting models presented in this chapter.
- Is this investment worthwhile? Why or why not?

### Improving Decision Making: Using Web Tools for Buying and Financing a Home

**Software skills:** Internet-based software  
**Business skills:** Financial planning

This project will develop your skills using Web-based software for searching for a home and calculating mortgage financing for that home.

You have found a new job in Denver, Colorado, and would like to purchase a home in that area. Ideally, you would like to find a single-family house with at least three bedrooms and one bathroom that costs between $150,000 and $225,000 and finance it with a 30-year fixed rate mortgage. You can afford a down payment that is 20 percent of the value of the house. Before you purchase a house, you would like to find out what homes are available in your price range, find a mortgage, and determine the amount of your monthly payment. You would also like to see how much of your mortgage payment represents principal and how much represents interest. Use Yahoo!’s Real Estate site to help you with the following tasks:

- Locate homes in your price range in Denver, Colorado. Find out as much information as you can about the houses, including the real estate listing agent, condition of the house, number of rooms, and school district.
- Find a mortgage for 80 percent of the list price of the home. Compare rates from at least three sites. (Use search engines to find sites other than Yahoo!.)
- After selecting a mortgage, calculate your closing costs.
- Calculate the monthly payment for the mortgage you select.
- Calculate how much of your monthly mortgage payment represents principal and how much represents interest, assuming you do not plan to make any extra payments on the mortgage.
- When you are finished, assess the ease of use of the site and your ability to find information about houses and mortgages; the breadth of choice of homes and mortgages; and how helpful the whole process would have been for you if you were actually in the situation described in this project.

### Learning Track Module

*Information Technology Investments and Productivity.* Increases in business productivity from information technology investments have been difficult to measure. The Learning Track module on this topic describes why this is so. You can find it on the Student CD-ROM and the Laudon Web site for this chapter.
Summary

1. Identify and describe the objectives of project management and why it is so essential in developing information systems.

A high percentage of information systems projects take more time and money to implement than originally anticipated or are delivered with missing functionality. Good project management is essential for ensuring that systems are delivered on time, on budget, and provide genuine business benefits. Project management activities include planning the work, assessing the risk, estimating and acquiring resources required to accomplish the work, organizing the work, directing execution, and analyzing the results. Project management must deal with five major variables: scope, time, cost, quality, and risk.

2. Compare models for selecting and evaluating information systems projects and methods for aligning IS projects with the firm’s business goals.

Organizations need to identify and select IS projects that best support their business goals. They need an information systems plan that describes how information technology supports the attainment of their business goals and documents all their system applications and IT infrastructure components. Large corporations will have a management structure to ensure the most important systems projects receive priority. Once strategic analyses have determined the overall direction of systems development, enterprise analysis, critical success factors, portfolio analysis, and scoring models can be used to identify and evaluate alternative information systems projects.

3. Evaluate models for assessing the business value of information systems.

Information systems provide business value for a firm in many different ways, including increased profitability and productivity. Some, but not all, of these business benefits can be quantified and measured. Capital budgeting models are used to determine whether an investment in information technology produces sufficient returns to justify its costs. The principal capital budgeting models for evaluating systems projects are the payback method, accounting rate of return on investment (ROI), net present value, and internal rate of return (IRR). Real options pricing models, which apply the same techniques for valuing financial options to systems investments, can be useful when considering highly uncertain IT investments.

4. Analyze the principal risk factors in information systems projects.

The level of risk in a systems development project is determined by three key dimensions: (1) project size, (2) project structure, and (3) experience with technology.

A very large percentage of information systems fail to deliver benefits or solve the problems for which they were intended because the process of organizational change surrounding system building was not properly addressed. IS projects are more likely to fail when there is insufficient or improper user participation in the systems development process, lack of management support, and poor management of the implementation process. There is a very high failure rate among business process reengineering and enterprise application projects because they require extensive organizational change that is often resisted by members of the organization. System changes resulting from mergers and acquisitions are also difficult to implement successfully because they usually require far-reaching changes to business processes.

5. Select appropriate strategies for managing project risk and system implementation.

Building an information system is a process of planned organizational change that must be carefully managed. The term implementation refers to the entire process of organizational change surrounding the introduction of a new information system. Especially important is the relationship between participants in the implementation process, notably the interactions between system designers and users. Eliciting user support and maintaining an appropriate level of user involvement at all stages of system building are essential.

Management support and control of the implementation process are essential, as are mechanisms for dealing with the level of risk in each new systems project. Project risk factors can be brought under some control by a contingency approach to project management. The risk level of each project determines the appropriate mix of external integration tools, internal integration tools, formal
planning tools, and formal control tools to be applied. Appropriate strategies can be applied to ensure the correct level of user participation in the systems development process and to minimize user resistance. Information systems design and the entire implementation process should be managed as planned organizational change. Sociotechnical design aims for an optimal blend of social and technical design solutions.

**Key Terms**

- Accounting rate of return on investment (ROI), 569
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- Change agent, 573
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- Tangible benefits, 565
- User-designer communications gap, 573
- User interface, 556

**Review Questions**

1. Why is project management so important for information systems projects?
2. What kinds of information systems problems result from poor project management?
3. What is project management? List and describe the project management activities and variables addressed by project management.
4. Name and describe the groups responsible for the management of information systems projects.
5. What are the major categories of an information systems plan?
6. How can enterprise analysis and critical success factors be used for selecting information systems projects?
7. Describe how portfolio analysis and scoring models can be used to select information systems projects.
8. List and describe the major costs and benefits of information systems. What is the difference between tangible and intangible benefits?
9. Name and describe the principal capital budgeting methods used to evaluate information system projects.
10. How can real options pricing models help evaluate information technology investments?
11. What are the limitations of financial models for establishing the value of information systems?
12. What dimensions influence the level of risk in each information systems project?
13. Why do builders of new information systems need to address change management?
14. What are implementation and counterimplementation?
15. Why are eliciting support of management and end users so essential for successful implementation of information systems projects? What is the user-designer communications gap?
16. Why is there such a high failure rate among enterprise application implementations and business process reengineering (BPR) projects? What role do information systems play in the success or failure of mergers and acquisitions?
17. What project management techniques can be used to control project risk?
18. What organizational considerations should be addressed by information systems planning and implementation?
19. How do project management software tools contribute to successful project management?
Discussion Questions

1. How much does project management impact the success of a new information system?
2. It has been said that most systems fail because systems builders ignore organizational behavior problems. Why might this be so?

Teamwork: Identifying Implementation Problems

Form a group with two or three other students. Write a description of the implementation problems you might expect to encounter in one of the systems described in the Interactive Sessions or chapter-ending cases in this text. Write an analysis of the steps you would take to solve or prevent these problems. If possible, use electronic presentation software to present your findings to the class.

Video Case

You will find a video case illustrating some of the concepts in this chapter on the Laudon Web site and Student CD-ROM along with questions to help you analyze the case.
The state of Maine provides medical coverage for over 260,000 of its residents through its Medicaid program. Healthcare providers, including doctors, hospitals, clinics, and nursing homes, submit claims to Medicaid in order to be paid for the services they provide to Medicaid patients. As the 1990s drew to a close, Maine, like many other states, began planning for a complete overhaul of its Medicaid claims processing systems to comply with the Health Insurance Portability and Accountability Act of 1996 (HIPAA). HIPAA was enacted to standardize the management of patient health and records, and, most notably, the protection of patient privacy. HIPAA provided a deadline of October 1, 2002, to meet its patient privacy and security standards.

Maine had to consider a number of factors in addition to HIPAA in preparing for its systems overhaul. The Medicaid program, as outlined by the federal government, was becoming increasingly complex with new services added, each with codes and subcodes assigned to them. As a result, payments to providers were broken down into smaller and more numerous pieces. The state also wanted to offer providers access to patient eligibility and claim status data online in the hopes of reducing the volume of calls to the state Bureau of Medical Services, which ran Medicaid under the Department of Human Services (DHS).

At the time, Maine was processing over 100,000 Medicaid claims per week on a Honeywell mainframe that dated back to the 1970s. The system was not capable of supporting HIPAA requirements or the online access that the state wished to implement. The state's IT department decided that a completely new system would be more cost-effective and easier to maintain than an upgrade of the old system. This approach contrasted with what some other states had done. Nearby Massachusetts, for instance, chose to deploy a Web portal as an integrated front end to its existing legacy systems. However, the IT staff at the DHS believed a new custom-built system it would be more flexible because they could make it rule-based in order to accommodate frequent changes in Medicaid rules. The IT staff also rejected an option to outsource claims processing systems to a service provider such as Electronic Data Systems (EDS).

For such a large and significant project, the DHS enlisted a private contractor to work with its IT staff. The state put out a request for proposals in April 2001. In October 2001, CNSI, one of only two firms to bid, received the contract for its $15 million proposal. The deal called for CNSI to complete and deploy the new processing system by the HIPAA compliance deadline, which was 12 months away. In actuality, the system debuted on January 21, 2005, almost 27 months later. However, the badly missed deadline was hardly Maine's biggest problem. The new system failed on many levels.

Shortly after its rollout, the new system was rejecting claims much more frequently than the old system had. Most of the rejected claims were being held up as suspended, a designation usually applied to claim forms that contained errors. The suspended file grew quickly, causing millions of dollars in claims to be held back.

Within two months, 300,000 claims were frozen. The Bureau of Medical Services could keep up neither with the number of phone calls nor the processing of the suspended claims. The 65 members of the DHS/CNSI team worked feverishly to fix software glitches, but their efforts were accompanied by a lack of regard for critical management guidelines. Meanwhile, some providers who weren't getting paid were forced to turn away Medicaid patients or even shut down their operations. Others sought bank loans to keep their practices fluid. Even the state's finances were threatened due to the significant portion of the state budget that Medicaid regularly ate up. Charlene Kinnelly, executive director of Uplift Inc., a nonprofit service provider for the mentally handicapped and mentally ill, reported that the state owed her organization $250,000. Seven thousand other nonprofits and healthcare service providers had not been compensated properly. Maine began issuing interim payments to providers that were based on their average claims.

The claims system software was error-prone, even issuing checks to doctors for their total charges for a procedure instead of the amounts that were actually covered by Medicaid. Overpayments eventually recovered by Maine Medicaid totaled $9 million. Providers were having difficulty filling out the new claim forms correctly, which was not a big surprise...
since some of the forms required 30 to 40 fields of information. The incorrect forms were among those claims that were flagged for the suspended file.

CNSI recommended that all providers re-enroll so that their information would be complete according to the new system's requirements. The department chose, instead, to transfer existing information from the old system, which was considered incomplete by the new system. Adding to the chaos when the problems began was the fact that only 13 people were on staff to handle customer service calls from 7,000 providers. The disaster cost the state an additional $30 million. More than a year after rolling out the new system, Maine was the only state that still had not satisfied the HIPAA requirements.

CNSI had never before designed a Medicaid claims system. Furthermore, that the state received only two proposals, and the one from a firm named Keane asking twice as much money as CNSI's, should have been a cause for alarm. J. Davidson Frame, dean of the University of Management and Technology in Arlington, Virginia, described the weak response to the Request for Proposal (RFP) as a sign that its requirements were unreasonable. Had Maine's procurement department sensed this at the time, the RFP could have been revised and the state likely would have received more bids that were in line with Keane's $30 million initial proposal. After all, Keane had worked on similar systems, including Maine's Medicaid eligibility processing.

B. Chatterjee, president of CNSI, admitted that his company lacked the experience of working with Medicaid systems and described CNSI as "a no-name company" looking for an entry-way into claims processing system management. Chatterjee assumed that his Rockville, Maryland-based information technology firm could rely on end users' Medicaid background to form a successful team.

Citing the scalability requirements of the project, CNSI planned the programming based on J2EE (Java Platform Enterprise Edition), which was a mismatch with the legacy code from the old system. Dick Thompson, who was then head of procurement for the state of Maine, defended the decision to select CNSI by pointing out that the state was not in a position to overspend and the time constraints of the HIPAA deadline gave the state little time to delay its decision. Budget concerns also prevented the project from being properly staffed, which slowed development during the design phase and hampered response time once the complaints started piling up.

The team had difficulty getting consulting time with the Medicaid experts on staff at the Bureau of Medical Services. The DHS IT staffers and CNSI contractors were forced to make judgments about Medicaid rules and requirements without the proper input. The team then had to reprogram parts of the system once the Medicaid experts became available. One break came when the federal body that runs Medicaid extended the HIPAA deadline by a full year to October 1, 2003. However, the DHS team continued to fight against the tide, fixing errors, writing new code to accommodate Medicaid rules changes, and adding storage capacity and processing power to support the new rules. Sensing that they would never catch up, the team began to take shortcuts. Comprehensive testing of the system was deemed impossible due to time constraints. Moreover, despite informing providers of the new system and new provider ID codes, the state did not offer training for providers on the new system; nor did the state properly train the staff that would be responsible for fielding calls from providers with problems.

When the DHS, now merged with the Department of Behavioral and Developmental Services as the Department of Health and Human Services (HHS), decided to launch the new claims processing system in January 2005, it did so with a clean break from the legacy system. There was no backup or parallel system to support the deployment because the legacy system was incompatible with the new code numbers (representing provider tax ID numbers and patient social security numbers) and electronic claim forms, and a parallel system was not feasible economically or technically. The one backup plan in place was a provision to pay providers for two to four weeks based on their average monthly claims payments in case of a failed deployment.

Within a few days of going live with the system, Craig Hitchings, director of information technology for DHS, noticed that the system was suspending an unusually high number of claims, around 50 percent or 24,000 claims in the very first week. The old system had rejected claims at a rate of 20 percent on average. And then the calls started coming in. Providers whose claims had been suspended were filing second claims, which were suspended automatically by the system because they were tagged as duplicates. The Bureau of Medical Services could not remedy the botched claims nearly as fast they were coming in. Soon there were 100,000 claims stuck in the system. Doctors were receiving statements in the
mail for rejected claims over and over. Medicaid was behind on $50 million worth of payments. At the same time, Hitchings and CNSI discovered programming and design problems in the system that limited the size of claim files to an unreasonable 1,000 lines of code. Providers calling to complain were rarely able to get through and suffered through seemingly interminable waiting periods on hold when they did. Maine’s healthcare system was in crisis, and the state budget was in danger of imploding.

In March 2005, Maine hired XWave, a project management consultant specializing in integration, for over $860,000 to right the ship. The problems persisted and as summer drew to a close, the backlog of suspended claims had reached 647,000 and providers were owed $310 million in payments. Rebecca Wyke, head of Maine’s financing department, awarded a $7 million contract to the accounting firm Deloitte & Touche to make sure that the state would be able to pay its Medicaid obligations and to help sort out the mess of bills. Thompson, who by now had been named CIO by Wyke, brought in Jim Lopatosky, an Oracle database specialist, to fill the role of operations manager. Lopatosky and XWave both determined that the project suffered from ineffective project management and a dearth of communication among Maine’s IT staff, CNSI, and the end users. Lopatosky worked to improve communications so that workers from the two branches of the team wouldn’t work on the same parts of the system unaware of what the other was doing. He also prioritized the troubleshooting process so that suspended claims could be cleared before less critical work was done.

Thompson added another significant piece to the puzzle in October 2005 by appointing Dr. Laureen Biczak to be the organization’s Medicaid expert. Thompson said, “It was something we should have done from the start: have someone who knew the business [of Medicaid] working full-time on the project.” Beginning in January 2006, questions from providers were filtered to Medicaid specialists working under Biczak if they were business-process issues, or to the IT department if they were hardware or software issues. With this filtering system in effect, Maine was able to reduce the claim suspension rate to about 15 percent with the remaining 85 percent of claims being processed properly as paid or denied. However, some providers still wondered why so much time and money was spent on a system that so far has not performed any better than the system it replaced, and, worse, caused harm to healthcare providers and their patients.

Chatterjee, whose company lost around $10 million on the project, believed that CNSI and the state bore responsibility for half of the problems, and providers who made mistakes on their claim forms could be blamed for the other half. He also insisted that Maine is better positioned to go forward than other states that updated their existing systems rather than building state-of-the-art new systems. In fact, CNSI has received additional state Medicaid contracts in the wake of its work with Maine. Maine was hopeful that its system would finally be fully functional sometime in 2006.


CASE STUDY QUESTIONS

1. How important are information systems for Maine’s Department of Health and Human Services? Analyze the impact of its faulty Medicaid claims processing system.

2. Evaluate the risks of the Medicaid claims processing system project and key risk factors.

3. Classify and describe the problems the Maine Department of Human Services faced in implementing its new Medicaid claims processing system. What management, organization, and technology factors caused these problems?

4. Describe the steps you would have taken to control the risk in the IT modernization project.

5. If you were in charge of managing this project, what else would you have done differently to increase chances for success?