CHAPTER

14 Making the Business Case for Information Systems and Managing Projects

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

14-1 How should managers build a business case for the acquisition and development of new information systems?

14-2 What are the objectives of project management, and why is it so essential in developing information systems?

14-3 What are the principal risk factors in information systems projects?

14-4 How can project risks be managed?

14-5 How will MIS help my career?

CHAPTER CASES

Al-Asasyah Implements a Modern ERP Solution

Sauder Woodworking Gets ERP Implementation Right

Arup Moves Project Management to the Cloud

Pennsylvania's Unemployment Compensation Modernization System: Unfinished Business

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NASA Project Management Challenges

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Al-Asasyah Implements a Modern ERP Solution

Al-Asasyah, also operating as Basic Electronics Company Ltd., is a Saudi company that specializes in selling electronic products and electrical appliances. Since 1961, the company has been expanding and diversifying into new branches of business, including biomedical equipment and security systems. It is currently an exclusive agent in the Kingdom of Saudi Arabia for many leading international brands. The company has around 1,000 employees across many distribution facilities and after-sale service centers spread throughout the Kingdom. The total working capital of the company is around SAR 120 million (over $32 million) and the total storage space at its warehouses exceeds 150,000 square meters.

Al-Asasyah used to have five main legacy systems, and its fast-growing business led to serious problems with accuracy, consistency, and accessibility of data. The different databases and file formats prevented the systems from providing effective communication among the different sites of the company. Attempts to remodel the systems to communicate the data appeared expensive and sometimes not feasible. As the legacy systems were unable to support direct, online communication with customers, partners, and suppliers, they were essentially incapable of maintaining any modern business model that would support the rapidly expanding company.

In 2014, Al-Asasyah acknowledged the seriousness of the problem, and a decision was made to replace the old systems with a new ERP solution. The company believed that implementation of an ERP system would be a challenging project to manage, so an internal team was formed to take on this responsibility. This team included managers with good knowledge of the company business processes, staff experienced in the old systems, and representatives from the different operational units of the company. At the pre-initiation phase of the project, the team set a number of constraints upon the selection of the ERP company to implement the solution, scrutinizing its history, successes and failures, cultural familiarity, etc. The team finally decided to adopt the SajayaERP solution. Sajaya is a software development and consulting firm in Saudi Arabia.

At the initiation phase, the company's internal team and the SajayaERP implementation team determined the scope, the outline plan, and a rough estimation of the cost of the project. Afterwards, the team developed a detailed plan that included a comprehensive implementation schedule, control and monitoring processes, change management model, and a more accurate cost estimation. The plan also included a detailed description

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of the company business processes and policies, system interface, the customizations needed, and report requirements.

The team decided to implement the execution phase through a number of subphases. First, a prototype of the system was run for three months in a small facility with a small number of transactions to allow more control over the testing and evaluation process. Second and third prototypes were then run at other sectors of the company. These consecutive runs enabled users from different departments of the company to get familiar with the main features of the system and freely evaluate it based on their own experience.

After the system passed the evaluation and testing stage, the final phase of execution focused on transferring the data from the legacy systems to the new one. The procedure was carefully designed, and the data was locked from changes for 10 weeks. All the changes that occurred to the data during this period of time were identified and then finally transferred to the ERP system. The whole system was then run for the first time and the old legacy systems were switched to a view-mode to be used for comparisons only. The old systems were finally switched off.

The whole project took eight months to complete. Al-Asasyah announced that it has seen the benefits of the project across all sectors of the company, and it credited the practical and effective project management as one of the main reasons for the successful implementation of the ERP system.

Sources: Basic Electronics Company Ltd. website, www.al-asasyah.com, accessed January 13, 2021; Sajaya.com Case Study, www.sajaya.com accessed December 18, 2018.

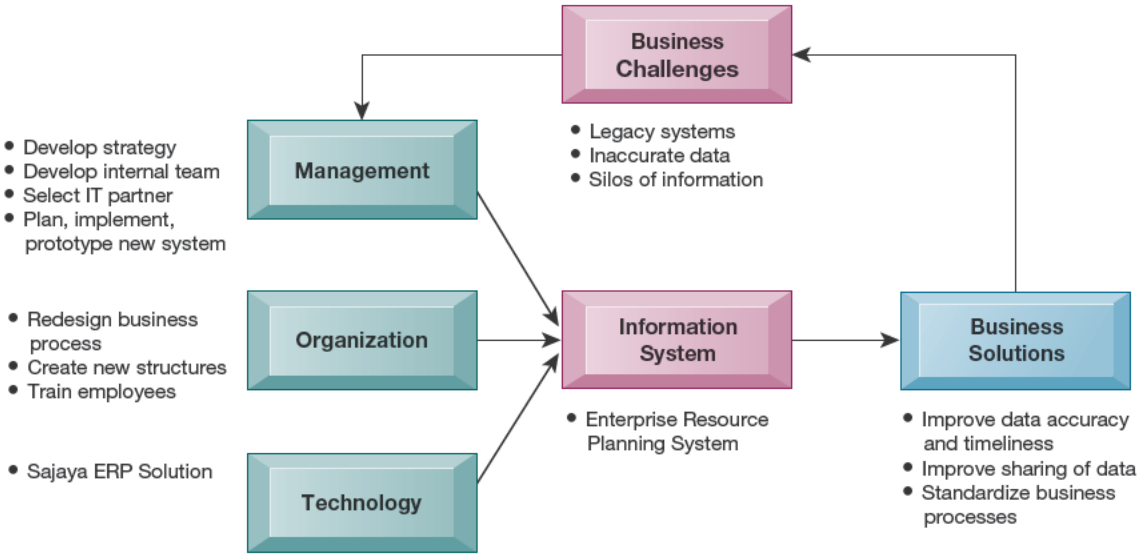
Case contributed by Yasser Mohamed Ibrahim Sabri, Cairo University

One of the principal challenges posed by information systems is ensuring they deliver genuine business benefits. There is a very high failure rate among information systems projects because organizations assess their business value incorrectly or because firms fail to manage the organizational change surrounding the introduction of new technology. Projects to build or improve information systems require special managerial and organizational techniques to make them effective.

The management at Al-Asasyah realized this when it undertook its project to implement a new modern ERP system. The new technology involved changes to important business processes as well as new software. Al-Asasyah succeeded because its management clearly understood that strong project management and attention to the execution details were essential to success.

The chapter-opening diagram calls attention to important points raised by this case and this chapter. Al-Asasyah's rapid growth and antiquated legacy systems called for more automated, state-of-the art solutions that could quickly consolidate data from the different remotely distributed sectors of the company. Outdated legacy systems made the entire business process inefficient, preventing effective communication among the different operational units of the company. The management wisely assembled a project team composed of end users with good business knowledge, carefully implemented the project's plan, and worked closely with the specialist team from SajayaERP. The new system was implemented in manageable phases where users were carefully and systematically trained.

Here are some questions to think about: Why was this project successful? Why was it important to pay particular attention to project execution?



14-1 How should managers build a business case for the acquisition and development of new information systems?

One of the principal challenges posed by information systems is ensuring they 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. Projects to build or improve information systems require special managerial and organizational techniques to make them effective.

Companies typically are presented with many alternatives for solving problems and improving their performance, including the development of new information systems or enhancement of existing ones. There are far more ideas for systems projects than there are resources. Your company will need to select the systems projects investments that promise the greatest benefit to the business. And you will need to make the business case for why the solution you select provides the greatest value to the firm compared to other solutions.

A **business case** is a proposal to management seeking approval for an investment. The business case for an IT investment describes the problem facing the organization that can be solved by investing in a proposed system solution. It provides an analysis of all the costs, benefits, and risks associated with that investment and the justification for that proposed course of action. The business case describes the rationale for proceeding with an investment, and shows how the investment supports the firm's strategic goals and business objectives and how it fits in with the overall information systems plan of the firm. It also provides the information necessary to make an informed decision about whether to proceed with the investment and in what form. The business case explains how this investment will provide value for the business, and identifies any risks that could negatively affect outcomes. The business case identifies alternative solutions, along with the deciding factors for selecting the preferred option.

FIGURE 14.1 FACTORS TO CONSIDER IN MAKING THE BUSINESS CASE

There are seven factors that should be addressed when making the business case for a new information system.

A good business case will also describe how the proposed solution may require changes in organizational culture, systems, processes, and jobs.

Figure 14.1 summarizes the seven major factors that are used in making the business case for a specific new system. (Review the discussion of business drivers of information systems in Chapter 1.) These factors are: (1) long-term strategic (lowering production costs, differentiation of products and services, increasing the scope of the firm [e.g., global expansion,] and matching or exceeding competitor capabilities); (2) improved decision making; (3) customer and supplier relationships; (4) survival (required by the market); (5) new products and services; (6) financial rationale; and (7) fitting with the long-term IT plan of the firm. Smaller systems that focus on a single problem will focus on just a few of these elements, such as "improved decision making," "customer relationships," and "lowering costs," whereas larger system projects may well include all of these factors in making the business case.

The Information Systems Plan

In order to identify the information systems projects that will deliver the most business value, organizations need a corporate-wide **information systems plan** that supports their overall business plan, with strategic systems incorporated into top-level planning. The IS firm plan is developed by the Chief Information Officer, and is approved annually by the CEO and often the Board of Directors. The plan serves as a road map indicating the direction of systems development

TABLE 14.1 INFORMATION SYSTEMS PLAN

1.	Purpose of the Plan
	Overview of plan contents
	Current business organization and future organization
	Key business processes
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
	Networking and Internet
	Cloud services
	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
	Networking and Internet
	Cloud services
5.	Management Strategy
	Acquisition plans
	Organizational realignment
	Management controls
	Major training initiatives
	Human Resources strategy
6.	Implementation of the Plan
	Anticipated difficulties in implementation
	Progress reports and milestones

(the purpose of the plan), the rationale, the state of current systems, new developments to consider, the management strategy, the implementation plan, and the budget (see Table 14.1). Without a comprehensive firm-wide IS plan, it is difficult, if not impossible to evaluate the worth of proposals for developing specific individual systems. You cannot make the case for a specific new system without understanding the larger context of all the many systems in the firm.

The plan contains a statement of corporate goals and specifies how information technology will support the attainment of those goals. It explains 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, technology, and required organizational change.

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

The plan should describe organizational changes, including management and employee training requirements; changes in business processes; and changes in authority, structure, or management practice. When you are making the business case for a new information system project, you show how the proposed system fits into that plan.

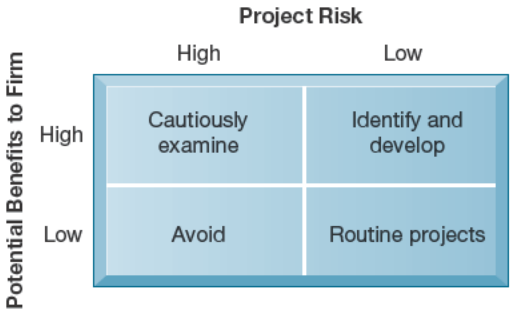
Portfolio Analysis

Once strategic analyses have determined the overall direction of systems development, **portfolio analysis** can be used to evaluate alternative systems 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 14.2) similar to a financial portfolio.

Each information systems project carries its own set of risks and benefits. (Section 14-3 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.

FIGURE 14.2 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.



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 IT investments with business objectives, and better organization-wide coordination of IT investments.

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

TABLE 14.2 EXAMPLE OF A SCORING MODEL FOR AN ERP SYSTEM

CRITERIA	WEIGHT	ERP SYSTEM A %	ERP SYSTEM A SCORE	ERP SYSTEM B %	ERP SYSTEM B SCORE
1.0 Order Processing					
1.1 Online order entry	4	67	268	73	292
1.2 Online pricing	4	81	324	87	348
1.3 Inventory check	4	72	288	81	324
1.4 Customer credit check	3	66	198	59	177
1.5 Invoicing	4	73	292	82	328
Total Order Processing			1,370		1,469
2.0 Inventory Management					
2.1 Production forecasting	3	72	216	76	228
2.2 Production planning	4	79	316	81	324
2.3 Inventory control	4	68	272	80	320
2.4 Reports	3	71	213	69	207
Total Inventory Management			1,017		1,079
3.0 Warehousing					
3.1 Receiving	2	71	142	75	150
3.2 Picking/packing	3	77	231	82	246
3.3 Shipping	4	92	368	89	356
Total Warehousing			741		752
Grand Total			3,128		3,300

requirements met for each function by the weight attached to that function. ERP System B has the highest total score.

Determining Solution Costs and Benefits

As we pointed out earlier, the business case for a system solution includes an assessment of whether each solution represents a good investment for the company.

Even if a systems 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,

TABLE 14.3 COSTS AND BENEFITS OF INFORMATION SYSTEMS

COSTS
Hardware
Networking
Software
Services
Personnel
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
Improved customer experience
Increased organizational learning
Legal requirements attained
Enhanced employee goodwill
Increased job satisfaction
Improved decision making
Improved operations
Higher client satisfaction
Better corporate image

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 systems for collaborative work (see Chapter 2). For instance, when BDO Canada switched from a homegrown project management tool to Microsoft Project Online, tangible benefits were increased productivity and lower operational costs resulting from streamlining the project management process. Intangible benefits included more timely and complete information, along with improved decision making.

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. TCO analysis, however, provides only part of the information needed to evaluate an information technology investment because it typically does not deal with benefits, cost categories such as complexity costs, and "soft" and strategic factors discussed later in this section.

Capital Budgeting for Information Systems

To determine the benefits of a particular project, you'll need to calculate all of its costs and all of its benefits. Obviously, a project where costs exceed benefits should be rejected. But even if the benefits outweigh the costs, additional financial analysis is required to determine whether the project represents a good return on the firm's invested capital. **Capital budgeting** models are one of several techniques used to measure the value of investing in long-term capital investment projects.

Capital budgeting methods rely on measures of cash flows into and out of the firm; capital projects generate those cash flows. 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.

The principal capital budgeting models for evaluating IT projects are the payback method, the accounting rate of return on investment (ROI), net present value (NPV), and the internal rate of return (IRR). Figure 14.3 illustrates part of the capital budgeting analysis for a mobile online ordering system. You can find out more about how these capital budgeting models are used to justify information system investments in the Learning Tracks for this chapter.

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. Intangible 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.

FIGURE 14.3 CAPITAL BUDGETING FOR AN INFORMATION SYSTEM INVESTMENT

This spreadsheet illustrates a simplified capital budgeting analysis for a mobile sales ordering system.
Courtesy of Microsoft Corporation.

	A	B	C	D	E	F	G	H
1	Estimated Costs & Benefits - Mobile Online Ordering System							
2	Year		0	1	2	3	4	5
3			2019	2020	2021	2022	2023	2024
4	Costs							
5	Hardware							
6	50 iPads @$500		$25,000					
7	Cloud IaaS		$4,000	$2,000	$2,000	$2,000	$2,000	$2,000
8	Networking		$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
9	Software							
10	Mobile ordering app		$35,000					
11	Integration with ERP		$25,000					
12	Human Resources							
13	Business Staff		$10,000					
14	IT Staff + Consultants		$45,000	$2,000	$2,000	$2,000	$2,000	$2,000
15	Training		$7,000	$1,000	$1,000	$1,000	$1,000	$1,000
16	Maintenance and Support			$5,000	$5,000	$5,000	$5,000	$5,000
17		Annual Costs	$1,52,500	$11,500	$11,500	$11,500	$11,500	$11,500
18		Total Costs	$2,10,000					
19	Benefits							
20	Reduced labor costs			$52,000	$52,000	$52,000	$52,000	$52,000
21	Reduced errors and returns			$70,000	$70,000	$70,000	$70,000	$70,000
22		Annual Net Cash Flow	-$1,52,500	$1,10,500	$1,10,500	$1,10,500	$1,10,500	$1,10,500
23		Total Benefits	$4,00,000					
24								
25		Net Present Value	$2,68,407					
26		ROI	4.1%					
27		Internal Rate of Return	17.0%					

14-2 What are the objectives of project management, and why is it so essential in developing information systems?

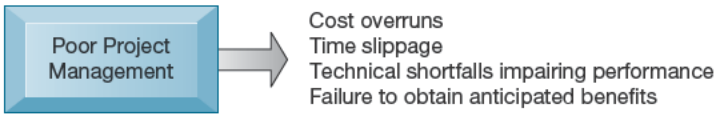
There is a very high failure rate among information systems projects. In nearly every organization, information systems projects take much more time and money to implement than originally anticipated, or the completed system does not work properly. When an information system does not meet expectations 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. That's why it's essential to have some knowledge about managing information systems projects and the reasons why they succeed or fail.

Runaway Projects and System Failure

How badly are projects managed? On average, private sector projects are underestimated by half in terms of budget and time required to deliver the complete system promised in the system plan. Many projects are delivered with missing functionality (promised for delivery in later versions). A joint study by McKinsey and Oxford University found that large software projects on average run 66 percent over budget and 33 percent over schedule. Over 50 percent of businesses surveyed by cloud project portfolio management provider Innotas had experienced IT project failure within the previous twelve months (Florentine, 2016).

FIGURE 14.4 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 may not be able to demonstrate any benefits to the organization.



As illustrated in Figure 14.4 a systems development project without proper management will most likely suffer these consequences:

- Costs that vastly 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 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. For example, the U.S. Navy had installed a new touch-screen navigation system on its John S. McCain destroyer with a design that was so confusing that the sailors using it accidentally guided the McCain into an oil tanker in the Singapore Strait on Aug. 21 2017 (Miller et. al, 2020).

Websites 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 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, enhancement of existing systems, or upgrade or replacement of 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 be to 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 does 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.

14-3 What are the principal risk factors in information systems projects?

We have already introduced the topic of information systems 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—contributes 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. 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 away from the project. 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

TABLE 14.4 THE USER-DESIGNER COMMUNICATIONS GAP

USER CONCERNS	DESIGNER CONCERNS
Will the system deliver the information we need for our work?	What demands will this system put on our servers?
Can we access the data on our smartphones, tablets, and PCs?	What kind of programming demands will this place on our group?
What new procedures do we need to enter data into the system?	Where will the data be stored? What's the most efficient way to store them?
How will the operation of the system change employees' daily routines?	What technologies should we use to secure the data?

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. According to the Project Management Institute, executive sponsors who are actively engaged is the leading factor in project success (Kloppenborg and Tesch, 2015; Project Management Institute, 2017).

Change Management Challenges for Business Process Management, 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 management projects which 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 far-reaching business process management 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 ambitious business process management 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, and changing job functions, career paths, and recruitment practices have posed greater threats to business process management than the difficulties companies faced visualizing and designing breakthrough changes to business processes. All of 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 effectively.

14-4 How can project risks be managed?

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 success.

The first step in managing project risk involves identifying the nature and level of risk confronting the project. Implementers can then handle each project with the tools and risk management approaches geared to its level of risk. Not all risks are identifiable in advance, but with skillful project management, most are. Frequent communication and a culture of collaboration will help project teams adapt to unforeseen problems that arise (Browning and Ramasesh, 2015; Laufer et al., 2015; 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 14.5). It shows each task as a horizontal bar whose length is proportional to the time required to complete it.

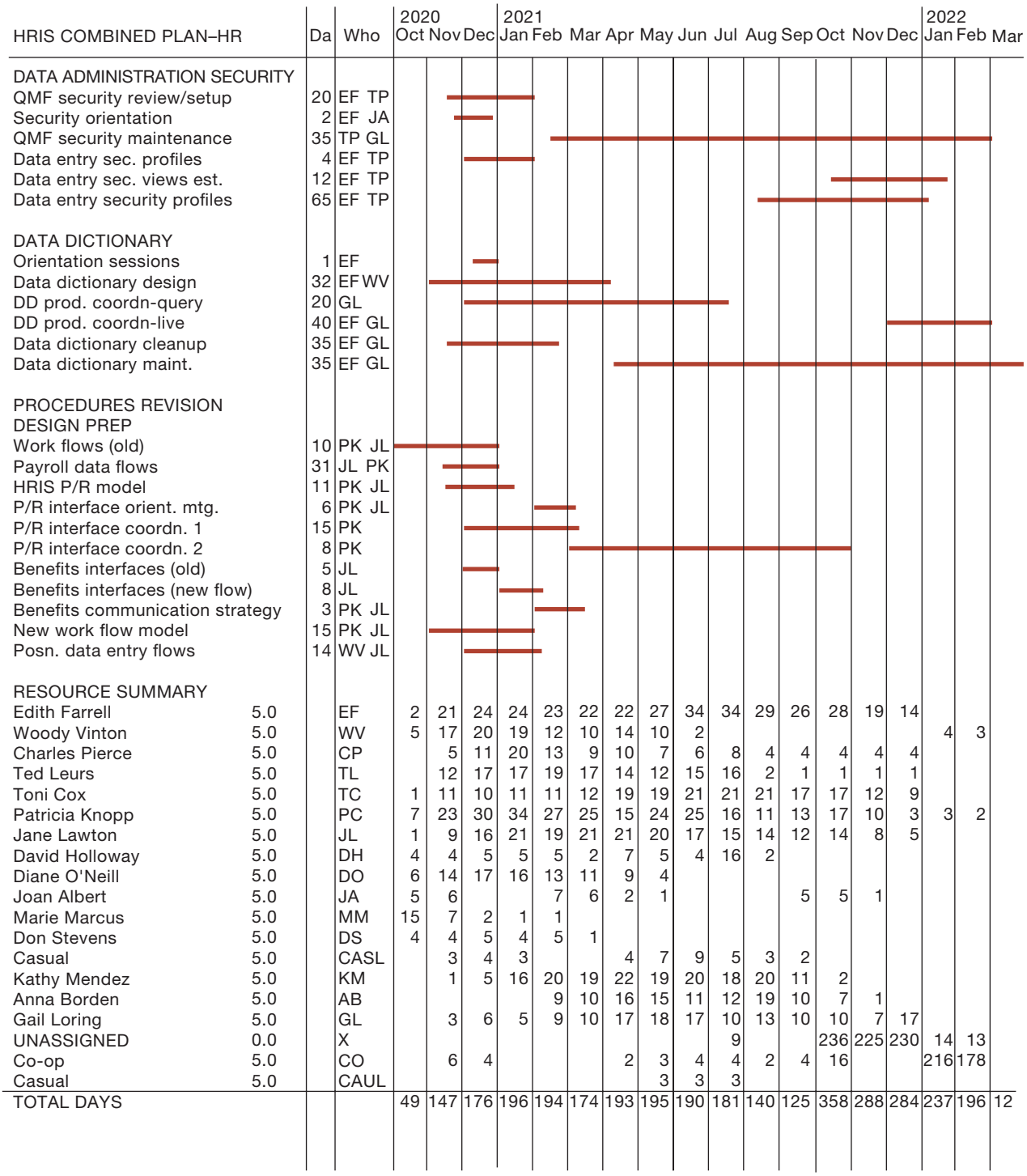
Although Gantt charts show when project activities begin and end, they don't depict task dependencies, how one task is affected if another is behind schedule, or how tasks should be ordered. That is where **PERT charts** are useful. *PERT* stands for "Program Evaluation and Review Technique," a methodology 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 14.6.

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 14.6, 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.

FIGURE 14.5 A GANTT CHART

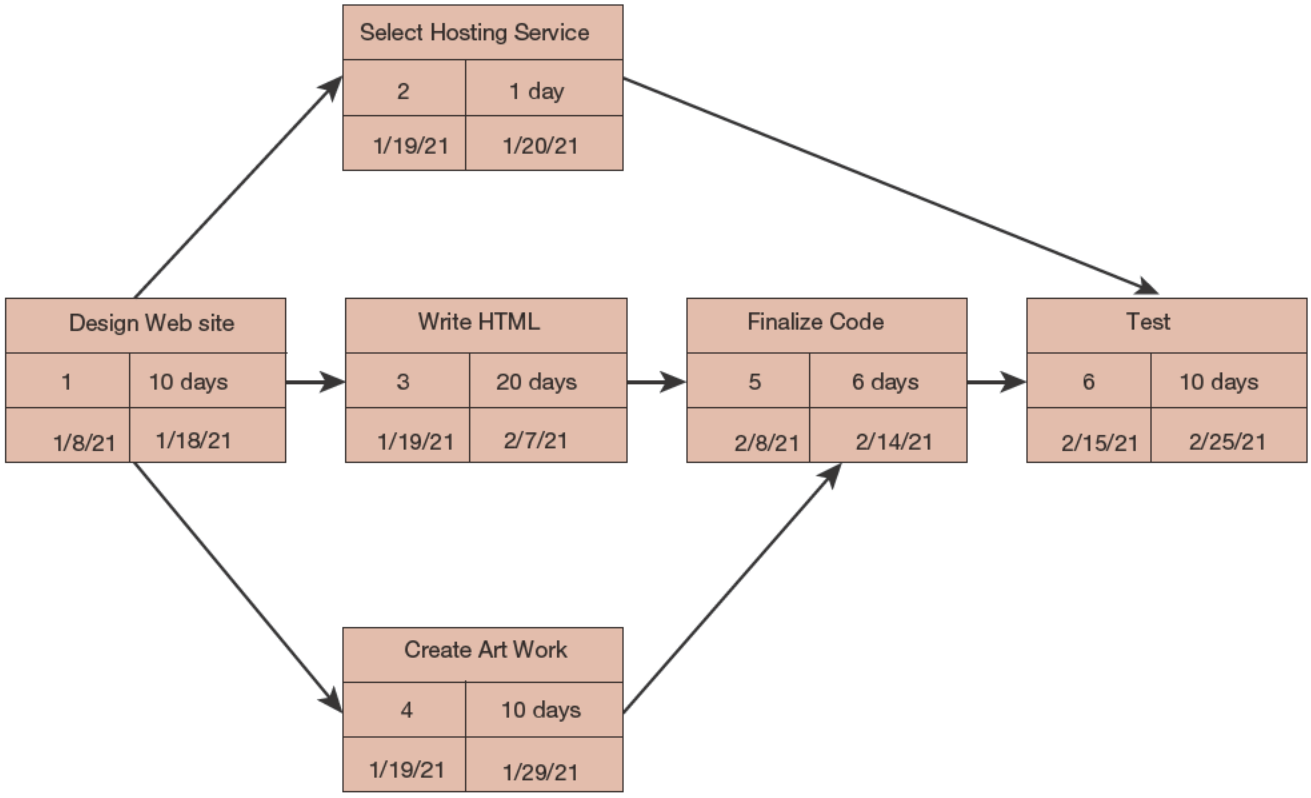
The Gantt chart in this figure shows the task, person-days, and initials of each responsible person as well as the start and finish dates for each task. The resource summary provides a good manager with the total person-days for each month and for each person working on the project to manage the project successfully. The project described here is a data administration project.



HRIS COMBINED PLAN–HR	Da	Who	2020 Oct	Nov	Dec	2021 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2022 Jan	Feb	Mar
DATA ADMINISTRATION SECURITY																				
QMF security review/setup	20	EF TP																		
Security orientation	2	EF JA																		
QMF security maintenance	35	TP GL																		
Data entry sec. profiles	4	EF TP																		
Data entry sec. views est.	12	EF TP																		
Data entry security profiles	65	EF TP																		
DATA DICTIONARY																				
Orientation sessions	1	EF																		
Data dictionary design	32	EF WV																		
DD prod. coordn-query	20	GL																		
DD prod. coordn-live	40	EF GL																		
Data dictionary cleanup	35	EF GL																		
Data dictionary maint.	35	EF GL																		
PROCEDURES REVISION DESIGN PREP																				
Work flows (old)	10	PK JL																		
Payroll data flows	31	JL PK																		
HRIS P/R model	11	PK JL																		
P/R interface orient. mtg.	6	PK JL																		
P/R interface coordn. 1	15	PK																		
P/R interface coordn. 2	8	PK																		
Benefits interfaces (old)	5	JL																		
Benefits interfaces (new flow)	8	JL																		
Benefits communication strategy	3	PK JL																		
New work flow model	15	PK JL																		
Posn. data entry flows	14	WV JL																		
RESOURCE SUMMARY																				
Edith Farrell	5.0	EF	2	21	24	24	23	22	22	27	34	34	29	26	28	19	14			
Woody Vinton	5.0	WV	5	17	20	19	12	10	14	10	2							4	3	
Charles Pierce	5.0	CP		5	11	20	13	9	10	7	6	8	4	4	4	4	4			
Ted Leurs	5.0	TL		12	17	17	19	17	14	12	15	16	2	1	1	1	1			
Toni Cox	5.0	TC	1	11	10	11	11	12	19	19	21	21	21	17	17	12	9			
Patricia Knopp	5.0	PC	7	23	30	34	27	25	15	24	25	16	11	13	17	10	3	3	2	
Jane Lawton	5.0	JL	1	9	16	21	19	21	21	20	17	15	14	12	14	8	5			
David Holloway	5.0	DH	4	4	5	5	5	2	7	5	4	16	2							
Diane O'Neill	5.0	DO	6	14	17	16	13	11	9	4										
Joan Albert	5.0	JA	5	6			7	6	2	1				5	5	1				
Marie Marcus	5.0	MM	15	7	2	1	1													
Don Stevens	5.0	DS	4	4	5	4	5	1												
Casual	5.0	CASL		3	4	3			4	7	9	5	3	2						
Kathy Mendez	5.0	KM		1	5	16	20	19	22	19	20	18	20	11	2					
Anna Borden	5.0	AB					9	10	16	15	11	12	19	10	7	1				
Gail Loring	5.0	GL		3	6	5	9	10	17	18	17	10	13	10	10	7	17			
UNASSIGNED	0.0	X										9			236	225	230	14	13	
Co-op	5.0	CO		6	4				2	3	4	4	2	4	16			216	178	
Casual	5.0	CAUL								3	3	3								
TOTAL DAYS			49	147	176	196	194	174	193	195	190	181	140	125	358	288	284	237	196	12

FIGURE 14.6 A PERT CHART

This is a simplified PERT chart for creating a small website. It shows the ordering of project tasks and the relationship of a task with preceding and succeeding tasks.



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.

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. **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.

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 mobile 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 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.

You can see some of these project management strategies at work in the Interactive Session on Management, which describes how Sauder Woodworking implemented a new state-of-the-art ERP system.

TABLE 14.5 ORGANIZATIONAL FACTORS IN SYSTEMS PLANNING AND IMPLEMENTATION

Employee participation and involvement
Job design
Standards and performance monitoring
Ergonomics (including equipment, user interfaces, and the work environment)
Employee grievance resolution procedures
Health and safety
Government regulatory compliance

INTERACTIVE SESSION MANAGEMENT

Sauder Woodworking Gets ERP Implementation Right

Sauder Woodworking is North America's leading producer of ready-to-assemble furniture, and one of the top five U.S. residential furniture manufacturers. 90 percent of Sauder furniture is manufactured in Archbold, Ohio, where the company was founded in 1934. (Sauder also sources furniture from a network of global suppliers.) Its Ohio facility has 4-million-square-foot floor space housing high-tech furniture-making equipment from around the world and 2,000 employees. The company offers nearly 50 furniture collections. Furniture-making requires skilled design, artistry, and attention to detail, and Sauder has historically excelled in these areas.

Sauder started using SAP ERP Central Component (ECC) software for enterprise resource planning (ERP) in 2004. ECC provides modules covering a full range of industry applications, including finance, logistics, HR, product planning, and customer service, linked together into a single, customizable system run on a database of the user's choice. As a modular system, SAP ECC is designed so that organizations can use the pieces they need, configured in a way that makes sense for their business. Sauder used a phased implementation approach, starting with the modules for order-to-cash (business processes for receiving and processing customer orders). Sauder finished implementing all the main SAP ECC modules by 2015.

By that time, SAP had released SAP S/4HANA, a more leading-edge version of its ERP system that features in-memory computing (see Chapter 6). Sauder management had to decide whether to optimize the SAP modules it had already implemented on premises or whether to switch to S/4HANA to take advantage of its new functionality. Switching to the newest version of SAP ERP software would require more work than sticking with Sauder's existing system. Management opted for an on-premises version of SAP S/4HANA so that it could implement the new S/4HANA suite on its own timeline rather than wait and then be pressured to change software when SAP withdrew support for the older ECC system.

Another decision was whether to go greenfield (a completely new implementation) or brownfield (converting the existing system to the new one). A greenfield implementation would require installing a clean installation of the ERP system, then importing all the relevant data. A brownfield implementation would entail converting the existing system to the new one, using the data from the ECC system. Sauder opted for the brownfield approach. A key factor in the decision to go brownfield was the number of employees (2,000) who would be impacted by having to deal with an entirely new system. They might have trouble learning the system or resist working with the system because it was so unfamiliar. Sauder didn't want to have to deal with a lot of change management.

Sauder was quite familiar with SAP software, which was the company's business processing engine. Sauder's SAP system supported over 1,600 users conducting business transactions with the software, including those for finance, supply chain management, and shop floor interactions with SAP. In 2018, Sauder's SAP system processed 1,624,169 shipments, 1,661,225 sales orders, 14,438,089 warehouse moves, 894,664 production receipts, and 1,624,684 invoices.

There were challenges: To minimize business disruptions, management wanted the SAP ECC system converted to SAP S/4HANA within 72 hours, a very narrow time frame for a project of this scope. There was no room for error. At the same time Sauder began transitioning to SAP S/4HANA, it also made major changes to its IT infrastructure. The company migrated off legacy IBM iSeries systems to a new platform based on Dell servers and storage area networks (SANs) in a VMware virtual environment (see Chapter 5). A *SAN* is a network of storage devices that can be accessed by multiple servers or computers, providing a shared pool of storage space. Sauder's IT staff had to learn how to support these new technologies, but was fortunately assisted by Symmetry consultants. Symmetry helps firms manage complex SAP implementations on a global scale. Symmetry had provided services to Sauder for over 12 years, and understood the nature of its business and technology environment.

The system was successfully converted within the 72-hour downtime window, including conversion of the production planning and detailed scheduling functionality of the SAP® Advanced Planning and Optimization component within SAP S/4HANA.

The cut over to the new S/4HANA system went very smoothly, with minimal disruption to the business, and the project was delivered on time and within budget.

The company plans to optimize its use of the S/4HANA system in phases, starting with finance functions. Running on SAP S/4HANA has positioned Sauder Woodworking better for achieving its strategic goals.

Sources: Eric Kavanah, "Measure Twice, Cut Once: Getting a Modern ERP Deployment Right," *eWeek,* February 11, 2020; "SAP S/4HANA Migration Case Study: Sauder Woodworking," symmetrycorp.com, accessed May 9, 2020; and "Sauder Woodworking," itelligence.com, accessed May 8, 2020.

CASE STUDY QUESTIONS

1. Why is an ERP system so important for Sauder Woodworking? Why did Sauder want to switch to a newer ERP system?
2. Was SAP S/4HANA a good choice for Sauder? Why or why not?
3. Were there any risks in this project? How did Sauder deal with them?

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 at both individual and team levels, and facilitating modifications to tasks and resources. Many automate the creation of Gantt and PERT charts and provide communication, collaboration, and social tools.

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. The most widely used project management tool today is Microsoft Project, but there are also lower-cost tools for smaller projects and small businesses. Many project management applications are now cloud-based to enable project team members to access project management tools and their data wherever they are working. The chapter-opening case and Interactive Session on Technology describe some capabilities of cloud-based Microsoft Project Online.

While project management software helps organizations track individual projects, the resources allocated to them, and their costs, **project portfolio management** software helps organizations manage portfolios of projects and dependencies among them. Project portfolio management software helps managers compare proposals and projects against budgets and resource capacity levels to determine the optimal mix and sequencing of projects that best achieves the organization's strategic goals.

INTERACTIVE SESSION TECHNOLOGY

Arup Moves Project Management to the Cloud

Arup Group Limited is a multinational professional services firm headquartered in London that provides engineering, design, planning, project management, and consulting services for all aspects of structures and environments of human construction. Founded in 1946, Arup now has over 16,000 staff based in 96 offices across 40 countries throughout the globe. The company defines itself as one where professionals of diverse disciplines—engineers, planners, designers, financial experts, consulting specialists, and sustainability professionals—can work together to deliver projects and services of greater quality than by working in isolation. Arup has worked on projects in over 160 countries, including the Pompidou Center in Paris, the Sydney Opera House, and the high-speed railway between London and Paris.

Arup is an intensive user of information technology in all aspects of its work, including working with clients, designing buildings, running structural simulations, and coordinating projects. Its management wants to ensure that Arup's information systems group is working on all the right IT projects for furthering the business and is doing so in the right way. Arup's systems have to be stable, leading edge, and available at all times, with employees able to access the information they need at any time and any place.

Until recently Arup's IT staff relied on Microsoft Excel spreadsheets or Microsoft Word documents as their project management tools. Reports were sporadic and in diverse formats, collaboration was very limited, project delivery styles were inconsistent, and there was no central visibility into what was happening with each project. Arup set up a Global IT Portfolio Management Office to oversee its entire portfolio of IT projects, but it was hampered by having to manually create reports using spreadsheets and email updates from regional offices.

Working with Program Framework consultants who specialize in project portfolio management, Arup decided to adopt Microsoft Project Online to improve project management. Project Online is Microsoft's cloud-based project management tool, and it helps organizations efficiently plan projects, track status, and collaborate with others from any location and any device. Members of Arup's global workforce have immediate access to project data at any time wherever they are working. The cloud solution also makes it possible to report on projects using live data, with the system able to tie in to other processes such as service and change management. Program Framework consultants helped Arup implement Project Online and train employees. They also developed a customized Project and Program Status Reporting capability for Project Online.

In the past, Arup's Global IT Portfolio Management Office had to spend 40 hours per month compiling reports manually. By the time it created a status report, the report was already out of date. Project Online gives Arup instant views into the status of all of its IT projects. Regional employees can view their own portfolios of projects, while Arup's Global IT Portfolio Management Office has immediate views of all global projects. Arup's management can examine and classify projects throughout the entire enterprise based on their red, green, and amber status indicators. (Red designates projects with critical status, while amber designates those at risk.) The ability to see Arup's entire project portfolio gives management better insight into project delivery. The Global IT Portfolio Management Office can obtain key project status summaries, and highlight reporting of individual projects where it can drill down for further detail, enabling it to make better decisions based on up-to-date data. Project Online has become essential for supporting a common approach to Arup's project management across the globe. There is less duplication of effort and more strategic value in Arup's overall project portfolio.

Project Online is part of Microsoft's cloud-based Office 365 software suite, so it works seamlessly with other Microsoft productivity and communication tools such as OneDrive for Business (cloud storage), Skype for Business (voice, video, chat), Yammer (enterprise social networking), and Visual Studio Team Foundation Server, which Arup uses for software development projects. Arup also plans to implement additional Project Online capabilities for demand and capacity planning, portfolio prioritization, and portfolio balancing. Users can easily copy information from Project and paste it into Office applications like PowerPoint and Word.

Arup uses Project Online for its IT Project Pipeline, a central repository of ideas for future development. Each idea recorded in the Pipeline requires that the initiator furnish information such as project description, budget, and resource needs.

Arup's Global IT Portfolio Management Office sends this information to Arup's management committee members to review and prioritize for new initiatives.

When ideas are approved, their Project Pipeline information can easily be transferred to active projects. It only takes a few minutes for Project Pipeline to create a project or program within Project Online. Each has its own Project Details Pages, which include a built-in schedule template and a connected Microsoft SharePoint Server site with document repository and status reporting. This capability saves Arup's Global IT Portfolio Management Office manager Carolyn Bundey several days of work for each new project, creating significant time savings for an annual portfolio of approximately 180 IT projects.

Several years ago, Project Online had about 150 users, but Arup is thinking about providing the tool for all of its employees. Arup licenses three different versions of Project Online. Project managers, owners, and administrators use Project Online with Project Professional for Office 365, enabling them to create and edit project plans inside or outside a web browser. Arup executives use Project Online to review project status. Project team members can view assignments or collaborate with other team members using the lower-cost Project Lite version.

Sources: "Engineering Firm Uses Cloud-Based Solution to Generate, Execute, and Monitor IT Projects," www.microsoft.com, accessed January 2, 2018; "Leading Arup at the Forefront of Innovation in Today's Built Environment," www.gineersnow.com, accessed January 3, 2018; and www.arup.com, accessed May 2, 2020.

CASE STUDY QUESTIONS

1. What is the relationship between information technology, project management, and Arup's business model and business strategy?
2. How does Microsoft Project Online support Arup's business strategy? How did it change the way the company works?
3. What management, organization, and technology issues did Arup have to address when selecting Project Online as its global project portfolio management tool?

14-5 How will MIS help my career?

Here is how Chapter 14 and this book can help you find an entry-level job as an IT project management assistant.

The Company

Focus Multimedia Entertainment, a large multinational mass media and entertainment company headquartered in Dublin, Ireland, is looking for an entry-level IT project management assistant. Focus Multimedia creates films, TV shows, recordings, streaming Internet content, interactive games, and consumer products for a worldwide audience. It is an intensive user of leading-edge information technology in its products, services, and operations.

Position Description

The IT project management assistant will help IT project managers with planning, budgeting, and overseeing all aspects of information technology projects for the firm. Job responsibilities include:

- Performing tasks designed to enhance the functions and services provided by the firm's centralized Project Management Office. This might include

identifying and documenting best practices, investigating available tools, and making recommendations for improving processes and procedures.

- Collaborating with project managers to ensure that the scope and direction of each technical project is on schedule.
- Working with other project stakeholders for support.

Job Requirements

- Bachelor's degree in Computer Science, Computer Engineering, Management Information Systems, Project Management, or a related field
- Knowledge of project management (PMI) teachings
- Knowledge of process documentation (process flow charting)
- Proficiency with Microsoft Word, Excel, PowerPoint
- Strong interviewing and research skills
- Experience with SharePoint and/or Microsoft Project desirable

Interview Questions

1. Have you ever worked on an IT project? What did you do? Did you work with any project management tools such as Microsoft Project?
2. Did you ever work on a non-IT project? What were your responsibilities? Did you use project management software for your work?
3. Have you taken course work in project management? What do you know about process documentation?
4. What is your proficiency level with Microsoft Office tools and with Microsoft Project and SharePoint?

Author Tips

1. Review this chapter and also Chapter 13 on building information systems to familiarize yourself with project management and systems development techniques and methodologies.
2. Use the web to do more research on project management methodologies and tools. Explore the Project Management Institute (PMI) website or review the Project Management Institute's book, *A Guide to the Project Management Body of Knowledge*.
3. Try to find information on how projects are managed at XYZ Multimedia. Inquire what project management methodologies and tools are used at this company. If possible, show you are familiar with these tools and approaches.
4. Provide examples of any project management work you have done in your courses or on a job. Alternatively, provide examples of your writing and verbal communication skills.

REVIEW **SUMMARY**

14-1 How should managers build a business case for the acquisition and development of new information systems?

The business case for an IT investment describes the problem facing the organization that can be solved by investing in a proposed system solution. It provides an analysis of whether an information system project is a good investment by calculating its costs and benefits. Tangible benefits are quantifiable, and intangible benefits cannot be immediately quantified but may provide quantifiable benefits in the future. Benefits that exceed costs should be analyzed using capital budgeting methods to make sure they represent a good return on the firm's invested capital. Organizations should develop an information systems plan that describes how information technology supports the company's overall business plan and strategy. Portfolio analysis and scoring models can be used to evaluate alternative information systems projects.

14-2 What are the objectives of project management, and why is it so essential in developing information systems?

Good project management is essential for ensuring that systems are delivered on time and 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.

14-3 What are the principal risk factors in information systems projects?

The level of risk in a systems development project is determined by (1) project size, (2) project structure, and (3) experience with technology. 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 projects involving business process management, enterprise applications, and mergers and acquisitions because they require extensive organizational change.

14-4 How can project risks be managed?

Implementation refers to the entire process of organizational change surrounding the introduction of a new information system. User support and involvement and 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. Project management software helps organizations track individual projects and project portfolio management software helps them manage portfolios of projects and dependencies among them.

Key Terms

Business case, 561
Capital budgeting, 567
Change agent, 571
Change management, 571
Counterimplementation, 576
Ergonomics, 577
External integration tools, 576
Formal control tools, 574
Formal planning tools, 574
Gantt chart, 574
Implementation, 571
Information systems plan, 562
Intangible benefits, 566
Internal integration tools, 574
Organizational impact analysis, 577
PERT chart, 574
Portfolio analysis, 564
Project, 569
Project management, 569
Project portfolio management, 579
Scope, 570
Scoring model, 565
Sociotechnical design, 577
Tangible benefits, 566
User-designer communications gap, 572
User interface, 569

MyLab MIS

To complete the problems with MyLab MIS, go to the EOC Discussion Questions in MyLab MIS.

Review Questions

14-1 How should managers build a business case for the acquisition and development of new information systems?

- Define and describe the components of a business case for a proposed investment.
- List and describe the major components of an information systems plan.
- Explain the difference between tangible and intangible benefits.
- List six tangible benefits and six intangible benefits of an IT investment.
- Describe how capital budgeting, portfolio analysis, and scoring models can be used to establish the worth of systems.

14-2 What are the objectives of project management, and why is it so essential in developing information systems?

- Describe information system problems resulting from poor project management.
- Define project management. List and describe the project management activities and variables addressed by project management.

14-3 What are the principal risk factors in information systems projects?

- Explain the role of a systems analyst as a change agent.
- Explain what is meant by the term user-designer communications gap and why it is often a major problem.
- Explain why projects related to mergers and acquisitions tend to have higher-than-average failure rates.

14-4 How can project risks be managed?

- Explain why eliciting support of management and end users is so essential for successful implementation of information systems projects.
- Identify and describe the strategies for controlling project risk.
- Explain what is meant by counterimplementation and why it might be adopted.
- Explain how project management techniques can be used to get around bottlenecks.

Discussion Questions

14-5 MyLab MIS How much does project management impact the success of a new information system?

14-6 MyLab MIS It has been said that most systems fail because systems builders ignore organizational behavior problems. Why might this be so?

14-7 MyLab MIS What is the role of end users in information systems project management?

Hands-On MIS Projects

The projects in this section give you hands-on experience evaluating information systems projects, 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. Visit MyLabMIS to access this chapter's Hands-On MIS Projects.

Management Decision Problems

14-8 Major corporations all over the world are large procurers of all kinds of goods, buying everything from staplers to cars. To keep track of the thousands or even millions of purchases made each year, modern corporations use e-procurement systems. For the Malaysian MajorCorp enterprise, a decision was made that one e-procurement system would replace a functional but older system over a weekend. Though no end users were involved with developing the new system, it was tested thoroughly from a technical viewpoint and approved by the IT department. On Monday morning, as the office personnel started trying to place orders as usual, they found themselves staring at the new, unfamiliar e-procurement system, and within minutes all lines to the IT support staff were busy. However, the new system worked for some people, so the new database records a large amount of data of questionable quality. Eventually, the new system was shut down, leaving the company with no choice but to take orders using paper and pen or whatever else came to mind. Something evidently went terribly wrong during the migration to the new system. What could MajorCorp have done to prevent this outcome?

14-9 Caterpillar is the world's leading maker of earth-moving machinery and supplier of agricultural equipment. Caterpillar wants to end its support for its Dealer Business System (DBS), which it licenses to its dealers to help them run their businesses. The software in this system is becoming outdated, and senior management wants to transfer support for the hosted version of the software to Accenture Consultants so it can concentrate on its core business. Caterpillar never required its dealers to use DBS, but the system had become a de facto standard for doing business with the company. The majority of the 50 Cat dealers in North America use some version of DBS, as do about half of the 200 or so Cat dealers in the rest of the world. Before Caterpillar turns the product over to Accenture, what factors and issues should it consider? What questions should it ask? What questions should its dealers ask?

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

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

14-10 This project provides you with an opportunity to use spreadsheet software to use the capital budgeting models discussed in this chapter and its Learning Tracks to analyze the return on an investment for a new computer-aided design (CAD) system.

Your company would like to invest in a CAD system that requires purchasing hardware, software, and networking technology as well as expenditures for installation, training, and support. MyLab MIS contains tables showing each cost component for the new system as well as annual maintenance costs over a five-year period, along with a Learning Track on capital budgeting models. You believe the new system will reduce the amount of labor required to generate designs and design specifications, 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's Learning Track.
- 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

14-11 This project will develop your skills using web-based software for searching for a home and calculating mortgage financing for that home.

You would like to purchase a home in Fort Collins, Colorado. Ideally, it should be a single-family house with at least three bedrooms and one bathroom that costs between 350,000 and $450,000 and can be financed 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. Use Realtor.com to help you with the following tasks:

- Locate homes in Fort Collins, Colorado, that meet your specifications.
- Find a mortgage for 80 percent of the list price of the home. Compare rates from at least three sites.
- After selecting a mortgage, calculate your closing costs and the monthly payment.

When you are finished, evaluate the whole process. For example, assess the ease of use of the site and your ability to find information about houses and mortgages, the accuracy of the information you found, and the breadth of choice of homes and mortgages.

Collaboration and Teamwork Project

Identifying Implementation Problems

14-12 Form a group with three or four 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 Google Docs and Google Drive or Google Sites to brainstorm, organize, and develop a presentation of your findings for the class.

Pennsylvania's Unemployment Compensation Modernization System: Unfinished Business

CASE STUDY

The Pennsylvania Department of Labor and Industry (DLI) is responsible for the administration and operation of the state's unemployment compensation program, which provides temporary income to replace lost wages for qualified workers. DLI employs over 5,000 people and has approximately 200 offices statewide to serve Pennsylvania's 6.4 million workers and nearly 300,000 employers. Unemployment compensation (UC) claims are usually filed online or by telephone or mailed to a UC service center.

DLI had a legacy mainframe system for processing unemployment benefits that was over 40 years old. However, it became increasingly expensive to maintain and difficult to modify, with limited functionality for case management and integrating newer tools and technologies to enhance productivity.

In June 2006, DLI awarded IBM a fixed price contract totaling $109.9 million for the Unemployment Compensation Modernization System (UCMS), which would replace the antiquated mainframe system. The initial contract with IBM called for more modern and efficient technology and business processes for (1) maintaining wage records, (2) processing employer taxes, and (3) claims processing, payment, and appeals, to be completed by February 2010. IBM won the UCMS contract after a three-year bidding process, claiming to be the only vendor with the type of proprietary databases capable of supporting a totally integrated computer system.

However, this project experienced significant delays and cost overruns, ultimately costing nearly $180 million, with much of the system never completed when the contract expired in September 2013. By that time, the project was 45 months behind schedule and $60 million over budget. Pennsylvania taxpayers had paid IBM nearly $170 million for what was supposed to be a comprehensive, integrated, and modern system that it never got. IBM's contract was not renewed. In March 2017, Pennsylvania sued IBM for breach of contract, fraudulent and negligent misrepresentation, and charging taxpayers for services it did not provide. IBM said Pennsylvania's claims had no merit and that it would fight the lawsuit. A spokesman for the company laid some of the blame for the project's problems on the state, saying that there was responsibility on both sides for system performance and service delivery. How did all of this happen?

Phase 1 of UCMS (wage records) was implemented in May 2008. Phase 2, which included the employer tax portion of the system, went live in March 2011 but required additional work, which took years to fix. Phase 3 for benefit claims processing, payment, and appeals continued to lag behind with problems and ultimately never went live.

In 2012, DLI enlisted the Carnegie Mellon Software Engineering Insitute to conduct an independent assessment of the UCMS. The study was completed in July 2013, and recommended continuing work on remaining Phase 2 problems, but stopping work on Phase 3. Many of the problems it identified for Phase 3 could not be solved.

The Carnegie Mellon study found many flaws in the systems development process. IBM had extensive systems experience and technology knowledge but its proposal underestimated the project's scope and complexity. DLI lacked sufficient staffing and experience for effective oversight and management of the contract and project. There was no formal delegation of roles and responsibilities for managing the project. No one at DLI was held accountable. DLI essentially relied on the contractor to self-manage.

UCMS was considered a large-scale software project due to its complexity, large number of information requirements and business rules, and its cost. DLI's solicitation for vendor proposals for UCMS exhibited ambiguity in communicating all of these requirements, and also neglected to define and describe quantitative and qualitative performance measures and metrics for the proposed system.

A large-scale software-intensive system such as UCMS requires a rigorous and disciplined testing strategy, but this was not implemented. IBM decided to use DLI users to help develop test scripts. They provided the business expertise, but IBM did not use IT test experts on its end. User acceptance testing was initiated before completing system tests for Phase 2 and Phase 3. Rigorous testing came too late in the project. DLI did not specify a minimum of metrics for UCMS system performance so that there were no identifiable criteria and evidence for determining that Phase 2 and Phase 3 application releases were stable.

DLI staff had approved IBM's representation of business system requirements without fully understanding what they were approving. IBM's software development and testing program for this project lacked rigor. This resulted in a higher number of software defects than industry norms, software code that was excessively complex (which makes testing too difficult), and late discovery of missing business requirements.

The vast majority of the software defects were serious, and 50 percent were not discovered until the User Acceptance test, very late in the system development cycle. Without thorough and complete testing throughout the development process, there is no way to know how many of the total defects residing in software will be discovered as a system is being used. Carnegie Mellon also found that IBM had not performed a stress test to determine the performance limits of the UCMS system.

IBM's software development plan was supposed to use industry and company standards and practices, but there was no ongoing discipline to execute these standards and practices during the project. DLI accepted Phase 2 prematurely for production in March 2011 with known defects impacting system performance, including software defects, unresolved data conversion issues, and problems with batch processing operations.

A project of this complexity and magnitude requires a high degree of continuity in knowledge throughout the system development cycle, but this was never achieved. During requirements determination, DLI didn't have enough user subject matter experts to participate in joint application design (JAD; see Chapter 13) sessions with technical members of the project team. Thirty-six JAD subcontractors were prematurely removed from the project, leaving IBM with incomplete understanding of unemployment claims processing business requirements. System design and testing staff were not included in the JAD process, running counter to sound business practice. Including them was essential to ensure UC business requirements were defined in sufficient detail to be testable. DLI staff often approved JAD requirements documents and Detailed System Design documents under pressure to meet short deadlines for approval.

Ineffective project management and constant changes in the contractor's workforce prevented transfer of essential knowledge for the entire project, a loss of "project memory." Since the UCMS project's start, 638 different contractors and staff members worked on the project. The majority of the project workforce spent less than one year on the project and 75 percent spent less than 2 years. All of these discontinuities and workforce churn most likely contributed to IBM's schedule delays and inability to provide an accurate picture of the state of the project.

Work on Pennsylvania's UC system continued without IBM. In 2013, the Pennsylvania Legislature passed Act 34, which created a Services Infrastructure Improvement Fund (SIIF) as a temporary supplemental funding source to improve UC services and systems. A total of $178.4 million was authorized and spent during calendar years 2013 through 2016. Even then the project stumbled. Pennsylvania Auditor General Eugene A. DePasquale initiated an audit in January 2017 to determine how the $178 million in SIIF funds were spent. The auditors found that DLI did not use proper accounting methods to record specific SIIF expenditures. DLI comingled unemployment compensation administrative funds from all sources, including federal funds for unemployment compensation administration and interest on unemployment compensation tax money as well as outlays from SIIF.

On a more positive note, there were noticeable improvements and efficiencies from 2013 through 2016 in services provided to UC claimants and in UC system infrastructure. For example, the percentage of first payments paid promptly increased from 81.6 percent to 93.4 percent. However, DLI was unable to show how exactly the SIIF expenditures contributed to these outcomes.

When SIIF funding was not reauthorized and supplemental funding ended in December 2016, DLI was forced to cut $57.5 million from its UC administrative budget for 2017, causing the immediate closure of three of the state's eight UC service centers in December 2016 and the elimination of 521 positions. Customer service declined significantly with claimants not being able to get through on the phone lines and delays in processing claims.

Despite earlier setbacks, DLI is determined to complete the modernization of its unemployment compensation benefits delivery system. In June 2017, DLI signed a $35 million contract with Florida-based Geographic Solutions to create a system that enhances customer service, improves quality, is more operationally efficient, and is sustainable into the future. Geographic Solutions specializes in designing, developing, and maintaining web-based systems for the workforce development and unemployment insurance industries and has developed over 80 workforce systems for state and

local agencies across the United States. Geographic Solutions was scheduled to begin work on the system on August 1, 2017 with a projected 18 to 24 months for completion.

In 2015, DLI had hired Chicago-based CSG Government Solutions for $6.1 million to assist with planning for and monitoring this project. CSG specializes in planning, managing, and supporting complex projects that modernize the information technology and business processes of large government programs. CSG analyzed existing systems and workflows, developed the project strategy and technology roadmap, and gathered business and technical requirements to develop an RFP. CSG also established a full-service Project Management Office to monitor project progress, and is providing technical oversight, UC subject matter expertise, requirements management, and testing support throughout the system modernization. Once the new system has been fully implemented, cost savings from benefit modernization are estimated to range from 5 to 10 percent of total UC administrative costs.

DLI's 2017 contract with Geographic Solutions specified that the new benefits delivery system was supposed to go live by April 30, 2018. As of the spring of 2020, the old system was still in place and unable to handle the millions of Pennsylvania workers who applied for benefits during the coronavirus pandemic shutdown. Geographic Solutions President Paul Toomey said the contract with DLI was an initial estimate based on similar systems in other states, but after analyzing the system they found over 1,000 programming changes required. Toomey added there was no additional cost increase and the project remained on budget and schedule for completion in October 2020.

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CASE STUDY QUESTIONS

14-13 Assess the importance of the Unemployment Compensation Modernization System project for the state of Pennsylvania.

14-14 Why was unemployment compensation modernization a risky project in Pennsylvania? Identify the key risk factors.

14-15 Classify and describe the problems encountered by the UCMS projects. What management, organization, and technology factors were responsible for these problems?

14-16 What could have been done to mitigate the risks of these projects?

Chapter 14 References

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