CHAPTER

3

IM/IT GOVERNANCE AND DECISION RIGHTS

Learning Objectives

1. Explain why strategic planning has become more important for healthcare organizations.
2. Summarize the five major components of information management/information technology (IM/IT) governance.
3. Describe the major elements of a healthcare organization’s planning elements.
4. Assess the major elements of a healthcare IM/IT strategic plan.
5. Describe systems theory and explain why it is vital to healthcare IM/IT governance and planning.

The competitive advantage that successful information management/information technology (IM/IT) governance may bestow has become the center of much discussion and even some debate. Smaltz, Carpenter, and Saltz (2007) and others (Broadbent and Kitzis 2005; Glaser 2002; Weill and Ross 2004) conclude that effective governance and expanding decision rights, inherent in IM/IT leadership, are essential for organizational success. The discussion of what governance and decision rights mean and how these concepts have evolved in healthcare organizations is a major portion of this chapter. Such emphasis on governance does not imply that the more traditional strategic information systems planning is either unimportant or out of date. Planning is still vital and is an important part of IM/IT governance.

Today, more than in the past, successful IM/IT governance and planning must address challenges from outside IM/IT operations. Broad questions that need to be addressed include: What is IM/IT governance? How does the governance model differ from historical strategic information systems planning? What changes must be made in organizations to transform IM/IT functions to a corporate asset?

This chapter presents an overview of IM/IT governance and strategic planning in healthcare organizations from the perspective of an integrated governance model. Topics covered include the background of governance and planning, the purposes of planning, the importance of system integration, organizing the IM/IT strategic planning effort, a brief introduction to systems theory, and management control and decision support systems.
Background of IM/IT Governance and Strategic Planning

Historically, information systems in many healthcare organizations evolved piecemeal, rather than resulting from a carefully controlled planning process. Specific requirements for capturing, storing, and retrieving data when needed were developed on an ad hoc basis as new programs and services were added. As a result, the same data were captured repetitively, files were duplicated, and information was not always available when needed. Analysts recognized that if an IM/IT planning process was not in place, priorities for development of individual computer applications were often established by the exigencies of the moment.

Recently, IM/IT priorities have changed to focus on integration of systems across multiple facilities, automation of patient records, and improved decision support for clinicians and managers. Achieving these complex objectives requires a careful planning process to develop a functional, scalable, and flexible information architecture that facilitates data exchange and provides users real-time access to information remotely from all locations.

Strategic information systems planning is the process of identifying and assigning priorities to the applications of information technology that will assist an organization in executing its business plans and achieving its strategic goals and objectives. This historical definition, which might have been seen as many as 10 years ago, does not sound much different from that of IM/IT governance above. Despite the similarities between the two definitions, there are subtle differences with regard to the importance of the external focus of healthcare IM/IT orientation. Many have analyzed IM/IT governance issues from theoretical perspectives to applied perspectives. While much conceptual work has been done, a useful conceptualization was developed recently that led to a Conceptual Framework for IT Governance (Brown and Grant 2005). The Conceptual Framework provided a logical structure for assessing the work of others by classifying prior efforts to understand IM/IT decision making as either related to governance (centralized versus decentralized decision framework) or a form of contingency analysis (why and how decisions are made in an organization). Menning and Carpenter (2005) provide a comprehensive review of current healthcare IM/IT governance alternatives in place, summarize the roles of governance, describe what works in healthcare, and list some potential impediments or pitfalls to avoid. This was done from the perspective of the experienced healthcare IM/IT leader. One of the few empirical investigations examines in detail how two very different organizations built and sustained an effective governance structure (Smaltz, Carpenter, and Saltz 2007). They conclude that governance effectiveness may depend in part upon attaining five domains of governance (strategic alignment, risk management, resource management, performance management, and value delivery). Finally, Weill and Ross (2004) developed characteristics of successful IM/IT...
governance that was presented as a component of healthcare IM/IT leadership in Chapter 2.

The importance of information systems planning has increased as healthcare organizations have grown in size and complexity and as information technology has become increasingly sophisticated. More than assigning management to coordinate an orderly planning process, healthcare IM/IT governance now requires managers to expand beyond IM/IT operations to ensure that information technology is used to effectively support the strategic priorities of the organization (Weill and Ross 2004; Menning and Carpenter 2005).

Discussions today with chief information officers (CIOs) often center on topics such as mergers, acquisitions and divestitures, and other strategic options for the organization, as opposed to internal operational issues and new technology. The Sixteenth Annual HIMSS Leadership Survey (HIMSS 2005a, Figures 8 and 9) revealed that reducing medical errors was the top priority identified by CIOs in the current period and was second only to implementing the electronic medical record as a priority in the next two years. This is just one example of how challenges outside of formal IM/IT operations occupy the attention of CIOs today.

Early in this decade, Gabler (2001) pointed out that governing boards and senior managers of healthcare organizations are increasingly concerned about the business value of investments in information technology and want assurances that information systems will deliver strategic benefits to the enterprise. Strategic IM/IT planning has assumed higher priority as a result.

**Purpose of Strategic Governance and IM/IT Planning**

IM/IT governance helps the organization make business decisions more accurately and in a timelier manner. With that benefit in mind, many have attempted to define the purpose and scope of IM/IT governance (Sambamurthy and Zmud 1999; Weill and Ross 2004; Broadbent and Kitzis 2005; Lutchen and Collins 2005). Although they reached no strict agreement, differences among these analysts are mostly nuance. Menning and Carpenter (2005) provide general guidelines, which, with some modification, appear in Figure 3.1 as the five primary components of successful healthcare IM/IT governance. Each component is discussed in more detail in the following sections.

**Developing a Consistent IM/IT Strategy**

Information systems should support the strategic goals, objectives, and priorities of the organization they serve. As healthcare organizations have become more sophisticated, they use information more effectively in strategic positioning within the environment in which they operate (Austin, Trimm, and Sobczak 1995, 27).
FIGURE 3.1
Components of IM/IT Governance

1. Developing a consistent IM/IT strategy
2. Aligning IM/IT with organizational strategy
3. Developing IM/IT infrastructure, architecture, and policies
4. Setting IM/IT project priorities, and overseeing investments in IM/IT infrastructure
5. Using IM/IT benefits assessment to enhance accountability

As mentioned above, hospitals and other healthcare organizations historically employed information technology to support day-to-day operations. Increasingly, healthcare managers are recognizing the role of information systems in increasing market share, supporting quality assessment and improvement, and adding value to the organization. To accomplish these strategic objectives, the IM/IT plan must be consistently applied across the multiple operating units with an organization. Creating consistent applications in an environment that has grown piecemeal and that consists of employees often not reporting directly to the CIO presents a challenge.

To demonstrate how this trend has evolved, the following information shows the growth and change in IM/IT planning. In 1996, 35 percent of the respondents to the Healthcare Information and Management Systems Society (HIMSS) annual leadership survey indicated that their organizations did not have a strategic IM/IT plan (HIMSS 1996). By contrast, in January 2002, only 8 percent of the responding organizations indicated that they did not have such a plan in place (HIMSS 2002). By 2005, the question of having a strategic IM/IT plan in place was not posed in the survey. It was replaced by a question asking whether the plan is an integrated component of the entire organization’s plan (46 percent responded yes) or is integrated in content but a separate plan (44 percent responded yes) (Scottsdale Institute and HIMSS Analytics 2005).

Aligning IM/IT with Organizational Strategy

The IM/IT plan must be closely aligned with the strategic plans of the organization. The issue of alignment has been an integral part of the IM/IT planning mantra for years (Wilson 1989; Ward and Griffiths 1996). Aligning IM/IT strategy with overall organizational strategy requires, first, a consistent IM/IT plan and, second, a view by IM/IT leadership that recognizes the importance of the interrelationships among IM/IT, the rest of the organization, and the external environment. Moreover, Stacey and Skinner (2005) argue that alignment involves three essential elements for success. First, an alignment of purpose must be in place. IM/IT leadership and organizational leadership must agree that they are trying to achieve the same ends. Second, they must agree to work to develop goals and tactics jointly to meet those ends. Third, these two groups must share the responsibility and accountability.
to achieve the ends. In the words of Stacey and Skinner (2005, 41), “we’re in this together.”

Because business objectives change over time, the information technology plan should be reviewed frequently to ensure it remains in alignment with current organizational strategy. Implementing an aligned plan is much more difficult than stating the need for alignment. To assist leaders in achieving strategic alignment, the following six questions must be addressed by the CIO and organizational leadership together from the perspective of the organization:

1. What does the organization do?
2. Who does the organization do it to or for?
3. Where does the organization do it?
4. When does the organization do it?
5. Why does the organization do it?
6. How does the organization do it?

Developing IM/IT Infrastructure, Architecture, and Policies

Healthcare organizations must make choices and set priorities for their information systems. The plan should identify the major types of information required to support strategic objectives and establish priorities for installation of specific computer applications, the architecture upon which the systems function, and the detailed rules that drive IM/IT operations.

To meet strategic objectives and develop high-priority applications, the healthcare organization must develop blueprints for its information technology infrastructure. This involves decisions about hardware configuration (architecture), network communications, degree of centralization or decentralization of computing facilities, and types of computer software required to support the network.

HIMSS has attempted to determine current and future information technology use and adoption through its annual leadership survey. It has found that use has not varied much during the first decade of the twentieth century. The 2005 annual leadership survey (HIMSS 2005a) identified the same four information technologies in current use as reported in the 2002 survey:

1. High-speed networks
2. Intranets
3. Wireless information systems
4. Client/server systems

After the infrastructure and architecture are developed as described above, the IM/IT steering committee (see discussion later in this chapter) should oversee the development of a set of enterprisewide policies that govern
the design, acquisition, and operation of information systems throughout the organization. Important policies needed by every organization include data security policies; data definition standards; policies governing the acquisition of hardware, software, and telecommunications network equipment; and policies on use of the Internet.

Data Standardization

As discussed previously, system integration is an important element of strategic IM/IT planning in healthcare organizations. Most computer applications must include the ability to share information with other systems. For example, a laboratory results-reporting system must be able to transfer information for storage in the computerized medical records system operated by the organization.

Electronic data exchange cannot occur without some level of standardization of data structures used in computer applications. For this reason, healthcare organizations should consider developing a data dictionary that specifies the format of each data element and the coding system (if any) associated with that element. For example, the data element “date of birth” might be defined as follows in the organization’s data dictionary:

Date of birth—Eight-digit numeric field with three subfields:
    Month—two digits ranging from 01 to 12
    Day—two digits ranging from 01 to 31
    Year—four digits ranging from 1850 to 2100

Notice that the range of the subfield for year in this example is designed to accommodate historical records of patients with birth dates back to the mid-nineteenth century and accommodate future records through the end of the twenty-first century.

In addition to data compatibility among information systems within the organization, there is a growing need to facilitate extra organizational exchange of information among health systems, government and private insurance companies, medical supply and equipment vendors, and other entities. A number of projects have been initiated to develop voluntary, industrywide standards for electronic data interchange in the healthcare field. Examples of these projects include the following:

- The American National Standards Institute (ANSI) (www.ansi.org/) X.12 Group is working on specifications for transactions involving the processing of health insurance claims.
- The Health Industry Bar Code Supplier Labeling Standard (www.hibcc.org/about.htm) is working to provide common coding of supplies, materials, and equipment.
- Health Level Seven (HL7) (version 3) (www.hl7.org/) is a standard for healthcare electronic data transmission.
The Healthcare Information Technology Standards Panel (HITSP) was awarded a contract from the U.S. Department of Health and Human Services to support a new collaborative effort to harmonize healthcare information technology standards.

The HL7 project was initiated in 1987. It is a voluntary effort of healthcare providers, hardware and software vendors, payers, consultants, government groups, and professional organizations with the goal of developing a cost-effective approach to system connectivity. It is aimed at the development of standards for clinical and administrative data. As with other standard-developing organizations certified by ANSI, HL7 develops messaging specifications that enable organizations to exchange clinical and administrative data. It has been working on improvements to these specifications since 1987; version 3 of HL7 embodies a new approach that addresses many of the weaknesses of earlier versions and encompasses messaging, component specifications, structured document architecture, and more. Even earlier versions provided a coherent set of standards for messages, component interfaces, and documents that all users can embrace (Beeler 2001).

The federal government has continued to support the creation and adoption of HL7 and other data exchange standards. As a part of the presidential initiative on consolidated health informatics, the departments of Health and Human Services, Defense, and Veterans Affairs announced the adoption of HL7 messaging standards along with prescription drug, imaging, and other standards in 2003 (Presidential Initiatives 2006). These standards enable the federal agencies to share information and improve coordination of care. Similarly, in the following year five additional standards related to information exchange were announced (Presidential Initiatives 2006).

In addition to these voluntary efforts at industrywide data standardization, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) established mandatory electronic data standards and standard transaction formats for claims processing. Providers are required to follow these standards to receive reimbursement from Medicare, Medicaid, and other health insurers. As a means of addressing growing mandatory standards, HITSP will bring together a wide range of stakeholders to identify, select, and harmonize standards for communicating data throughout the healthcare spectrum. Under a contract from the United States Department of Health and Human Services and the sponsorship of ANSI, HIMSS, the Advanced Technology Institute, and Booz Allen Hamilton (a strategic partner), HITSP will attempt to accelerate the adoption of health information technology and the secure portability of health information across the United States (HIMSS 2005b).

The purpose of HITSP is to develop a generally accepted set of standards specifically to enable and support “widespread interoperability, accurate use, access, privacy and security of shared health information” (HIMSS
HITSP is designed to function with public and private partnerships that have the potential to access much of the healthcare community. If successful in getting healthcare software developers and users to adopt these standards, it will buoy the Nationwide Health Information Network initiative for the United States called for by President George W. Bush by Executive Order #13335, which established the National Information Technology Coordinator.

As part of the strategic information systems planning process, the information systems steering committee should study requirements for data interchange, including HIPAA mandates, and should develop a policy on data standardization for the organization. For example, many hospitals and integrated delivery systems (IDSs) are specifying that all software purchased from vendors must meet an industry standard protocol such as HL7.

A number of technical policies related to information systems need to be developed by healthcare organizations. Most of these are highly technical and should be developed by the CIO or director of information systems. However, the information systems steering committee should oversee the development of a broad set of policies related to the acquisition of computer hardware, software, and network communications equipment for the organization.

The committee must determine whether the organization will require central review and approval of all computer hardware and software purchases. As the costs of personal computers and related software packages have come down, their purchase has moved to fall within the budgetary authority of individual organizational units. However, some compelling reasons exist for requiring central review and approval, regardless of cost, including the following:

1. Central review helps ensure compatibility with enterprisewide data standards such as HL7 (see above).
2. Central review of personal computer purchases can ensure that data terminals and workstations use a common operating system, such as Windows.
3. Central review and purchasing of generalized software provides cost advantages through the acquisition of site licenses for multiple users of common packages (word processing, spreadsheets, database-management systems, etc.).
4. Central review ensures that hardware and software will be of a type that can receive technical support and maintenance from the information systems staff.
5. Central review can help prevent illegal use of unlicensed software within the organization.
The information systems steering committee should also approve the network communications plan for the enterprise. A variety of network configurations is possible, and the network plan must be compatible with the overall information systems development plan for the organization.

**Setting IM/IT Project Priorities and Overseeing Investments in IM/IT Infrastructure**

The IM/IT function must also effectively oversee the purchase and implementation of IM/IT infrastructure consistent with the needs of the organization. The specialized knowledge and skills of IM/IT staff and the growing complexity of the underlying technology make this role vital to the success of IM/IT operations. While the use of technology has made information available and accessible to clinical and administrative staff across the organization, the infrastructure upon which software and other applications operate in the systems through which data are transmitted remains in the domain of IM/IT.

While end users are vital considerations in the priority-setting process, governance of IM/IT requires organizational IM/IT leadership to effectively manage the priorities among alternative investment options (Menning and Carpenter 2005). This management includes items directly from the IM/IT strategic plan such as an example, outlined by Stacy and Skinner (2005, 44), in which a hospital had to change all of its human resources, finance, patient accounting, and other support services information systems to enable integration with the rest of the health system and investments that arise episodically (a good example was Y2K considerations; see Wilson and McPherson [2002]).

**Using IM/IT Benefits Assessment to Enhance Accountability**

The final purpose of strategic IM/IT planning is to provide data to estimate the budget and resources required to meet the objectives and priorities established through the planning process. Planning will provide the basis for development of operating and capital budgets for information technology in the organization. The importance of this purpose has increased as CIOs report the growth in importance of the drive to obtain value from IM/IT (Glaser and Garets 2005). Turisco (2000, 13) called for value management in justifying information technology investments: “There is a growing demand for ensuring that healthcare [information technology] IM/IT investment practices and processes not only justify the large cash outlays, but track and realize the value. . . . Values can only be realized through measurable business changes supported by the business units.” More recently, the Center for Information Technology Leadership has published a number of articles arguing that greater documentation of IM/IT value is essential (e.g., Johnston, Pan, and Middleton 2002). This “call to the field” identified three dimensions from which to derive healthcare IM/IT value: financial, clinical, and organizational. The financial dimension is the most obvious source of value. It consists of cost
reductions, revenue enhancements, and productivity gains. Clinical enhancements would seek evidence of IM/IT’s impact on service delivery (adherence to protocols) and clinical outcome indicators. Organizational enhancements include such items as stakeholder satisfaction improvements and risk reduction. In all cases, Johnston, Pan, and Middleton’s fundamental point is that healthcare executives currently must rely on “anecdote, inference, and opinion to make critical IM/IT decisions” (2002, 1).

**Organization of the Planning Effort**

The development of information systems in a modern healthcare organization is a complex task involving major capital expenditures and significant staff commitments if the systems are to function properly. Development of a consistent, integrated master plan for information systems development is essential. To exclude this critical planning activity would be analogous to beginning a trip from New York to out West without knowing precisely where you are going (San Francisco? Seattle?), how you plan to travel (air, car, train, bus), what route you plan to take (northern, middle, southern), in what time frame you must get there, or how much money you have for the trip. While we would not do this as individuals, organizations continue to move directly into the acquisition of computer systems without any kind of master plan. The following sections provide guidelines for those organizations that have yet to implement an information systems strategic plan.

**General Approach**

The chief executive officer (CEO) should take direct responsibility for organizing the planning effort. As discussed above, appropriate governance creates an environment in which the board of trustees assigns responsibility, authority, and accountability to the CEO; thus the impetus for action rests with the CEO. Many structures have been proposed for this planning effort, ranging from highly centralized to informal discussions between the CEO and the CIO (Menning and Carpenter 2005). Naturally, the level of sophistication of this structure depends on the size and complexity of the organization and the nature of the environment in which it operates.

Generally, because the CEO often does not have the expertise or time to develop this plan, an information systems steering committee should be formed with representatives from major elements of the organization contributing to and benefiting from IM/IT functions. This committee should include representatives from the medical, nursing, financial management, human resources management, planning and marketing, facilities management, clinical support services, and information technology staff. The committee should be directed by a senior manager, preferably the CIO if such a position has been established. Strategic information planning is primarily a managerial function, not a technical one. A suggested organizational chart for the
planning effort is shown in Figure 3.2. The IM/IT steering committee will usually have subcommittees to better manage discrete aspects of the steering committee’s responsibilities. Specific subcommittees may differ as local needs dictate, but the following three components need to be specifically addressed:

1. **New and replacement IM/IT priorities.** The identification and planning for new and, importantly, replacement applications will serve to determine the scope of user needs.
2. **Infrastructure specifications.** Technology infrastructure specifications must include the most technically proficient members of your committee.
3. **Capital and operating budget.** The budget group is essential to keeping the scale and scope of technology needs under control.

Committee composition includes senior staff in IM/IT as well as representatives from the key constituencies across the organization. Additional personnel from the organization and technical consultants can be appointed members of specific subcommittees as needed. The chairs of the subcommittees usually come from the steering committee.

FIGURE 3.2
Organization Chart for the Planning Effort
Consideration also should be given to use of outside consultants if additional technical expertise is needed in the planning process. Except for the largest, most organizations cannot employ all of the specialized technical expertise necessary to make quality, informed decisions about information technology. Consequently, hiring these experts is a necessity, but consultants should be chosen carefully. They should possess technical knowledge of systems analysis and computer systems and should be well informed about health-care organizations. Consultants must be independent practitioners not associated with any equipment manufacturer or firm that sells software. When hiring independent consultants, executives must be sure that the consultants have no bias and stand to benefit from the decisions made, especially in cases when the organization lacks the in-house expertise to validate consultants’ recommendations. Finally, consultants should be familiar with the latest technological developments but must be able to resist the temptation to push for applications that are too close to the leading edge.

Lohman (1996) suggests that the following factors be considered in selecting an information systems consultant (the advice is still valid more than 10 years after publication):

1. Independence and objectivity. The consultant should exclusively focus on the interests of the client.
2. Healthcare expertise. The consultant should have an understanding of health-care business and clinical issues.
3. Resources. The consultant should have sufficient breadth and depth of resources to complete the assignment without “on-the-job training.”
4. Effective personality. The consultant should have an appropriate mix of character traits and skills.

Consultants should be used as sources of technical information and as facilitators of the planning process. They should not be employed to do the planning; this must be the responsibility of knowledgeable managers and users of information within the organization itself. Consultants can be of the most assistance by advising those on the steering committee of the functionality specifications of the technology or systems being considered and the system-level consequences of an action or decision. Before using a consultant’s “off the shelf” planning product, ensure that the planning methodology is compatible with the organization’s culture and strategic priorities.

Boyd (2005) presents an interesting set of reasons for and against outsourcing IM/IT. Although his discussion is more in the context of outsourcing fundamental IM/IT functions, the reasoning applies in the case of hiring consultants to advise the steering committee. Simply put, organizations should outsource to take advantage of the capacity and expertise of the external resource and reduce the fixed costs of having added expertise in-house.
The CEO should ensure that staff members participating on the steering committee are provided sufficient “release time” from their normal duties so that they can participate fully in the planning efforts. Release time estimates should be drawn up in advance, and formal written notification of this time should be provided to all involved. The administration and board of trustees should be prepared to spend a significant amount of the institution’s human resources on carrying out this important task.

As stated above, the organization’s CIO should chair the steering committee, if the CIO position has been established. Reporting directly to the CEO or chief operating officer, the CIO serves two important functions: (1) assisting the senior management team and governing board in using information to support strategic planning and management and (2) providing management oversight and coordination of information systems and telecommunications throughout the organization. See Chapter 2 for a full description of the role of CIO.

**Elements of a Strategic Information Systems Plan**

Figure 3.3 lists seven major elements that should be included in the strategic IM/IT plan, each of which is discussed in detail below.

The strategic IM/IT plan should begin with a review and concise statement of major organizational goals and objectives for the three- to five-year planning period. IM/IT goals and objectives should be aligned with the strategic objectives of the organization as mentioned above. For example, if reduction of medical errors is a major priority, then this goal should be reflected in the priorities for IM/IT development, paying particular attention to medical records, clinical protocols, clinical decision support systems, and incident reporting. If diversification and expansion of the market service base are strategic objectives, then information systems should focus on utilization analysis and forecasting, analysis of changes in the demographic profile of the service market, and analysis of resource requirements for new service development. If an urban medical center has placed priority on expansion of ambulatory care services, but IM/IT priorities continue to focus on inpatient services, then the organization has a serious problem of goal displacement.

Critical success factors are often used in defining information requirements and IM/IT goals during the planning process (Rockart 1979; Ward and Griffiths 1996). More recently, variations on the approach have been adopted. Kuperman and colleagues (2006) use a “requirements-driven” approach for quality improvement. They identified data warehousing and clinical encounter documentation as the critical factors that would lead to improved patient quality. Similarly, Johnson (2005) used a continuous cycle of assessment, prioritization, and scheduling to optimally allocate scarce information technology resources. Senior management needs to define these
FIGURE 3.3
Elements of the Information Systems Strategic Plan

1. Statement of corporate/institutional goals and objectives
2. Statement of information systems goals and objectives
   a. Management information needs
   b. Critical success factors
   c. Information priorities
3. Priorities for the applications portfolio
   a. Clinical
   b. Management/administrative
   c. Electronic networking and e-health
   d. Strategic decision support
4. Specification of overall systems architecture and infrastructure
   a. Level of distribution
   b. Network architecture
   c. Data location (central data warehouse to total data distribution)
   d. Integration via Internet
   e. Database security and control requirements
5. Software development plan
   a. Commercial packages
   b. In-house development
   c. Contract software development
   d. Application services providers
   e. Combinations of the above
6. Information systems management and staffing plan
   a. Central information systems staffing and control
   b. Limited central staffing in support of department-level information systems staff
   c. Outsourcing
   d. Combinations of the above
7. Statement of resource requirements
   a. Capital budget (hardware, software, network communication equipment)
   b. Operating budget (personnel, supplies, consultants, training, etc.)

requirements for IM/IT, but that level of management in healthcare organizations often has difficulty specifying its needs for management information. By specifying those critical areas where things must go right for the organization to flourish, managers assist the IM/IT planning team in determining information requirements and setting priorities for system development. Effectively communicating goals among these levels of the organization is critical to success.

Objectives should be as specific as possible and should flow from a review of strategic priorities and an analysis of deficiencies and gaps in current information processes. It is suggested that the CIO and other members of the steering committee consult a good text or “how to” book on strategic planning at this stage so that goals and objectives are well specified (Swayne, Duncan, and Ginter 2005). Avoid general statements of objectives such as “information systems...
for Metropolitan Health System should be designed to improve the quality of care and increase the efficiency of system operations.” Such statements are self-evident and nonfunctional as far as planning is concerned. Rather, a detailed list of objectives should be established that will provide specific targets against which future progress can be measured and systems can be evaluated. Examples of specific objectives might include the following:

- Information systems for the health plan should be designed such that all records from the master patient index file are available online to all physicians in the plan.
- Information systems for the clinic should be designed such that all diagnostic test results are available online within two hours after the tests have been completed.
- Information systems should be designed such that information on inpatient and outpatient activity by major diagnostic categories is reported to corporate management on a monthly basis, with reports indicating the health system’s share of the total services provided in the market area.
- Disease-management protocols for the ten highest-volume chronic conditions should be available online and should be used to provide automatic reminders to all physicians practicing in the hospital.
- If the organization is a university affiliated health system, expand the university’s current information infrastructure to optimally meet the ongoing needs of the institution in the areas of research, education, patient care, and community service.
- Support the institution’s information technology users through the formation of a service center.

These goals and objectives then provide the pool from which the organization must derive its set of key priorities.

Healthcare organizations will not be able to acquire all the systems they need in any given year. The statements of corporate and IM/IT objectives will aid the steering committee in preparing a priority list of individual computer applications to be acquired. The applications priority list, in turn, will be essential in planning how limited resources can be used to have the greatest impact on strategic priorities. Chapter 8 provides a comprehensive presentation and discussion of application opportunities.

The applications list should consider the needs of all major functional areas of the healthcare organization for financial, human resources, resource utilization and scheduling, materials management, facilities and project management, and office automation information systems. Both new and replacement systems should be considered, and the need for major changes to existing systems should be reviewed as well. Applications should be rank ordered in...
the recommended sequence for implementation, and items on the applications priority list should be linked to specific organizational strategies. If an information systems steering committee determines that financial control is the most pressing organizational problem, the development of a new financial information system might assume highest priority.

Many healthcare organizations have initiated programs of business process reengineering to achieve operational efficiency through dramatic improvement in core processes used in the organization. The pay-for-performance movement sponsored by government and business has raised the urgency of process improvement (Rosenthal et al. 2006). This broad movement makes clear not only the importance of IM/IT but also the involvement of all components of the delivery systems (Petersen et al. 2006). Many of these reengineering projects involve development of new information systems, and these should be considered by the information systems steering committee in developing the applications priority list.

After the priority list has been completed, the steering committee should report preliminary results back to the CEO and board of trustees. The statement of objectives and priority list should be carefully reviewed and modified as necessary to make sure that together they reflect the positions of senior management and the board.

Specification of overall systems architecture is a critical task in the planning process. Chapter 6 provides an overview of healthcare IM/IT system architecture and infrastructure. In short, the plan must specify an overall system architecture and infrastructure to include the following:

1. The degree to which computing will be centralized or decentralized throughout the organization. Opinions differ about the degree to which computing should be centralized or decentralized in healthcare organizations (DeFord and Porter 2005). Carr (2003) argues that IM/IT no longer matters for obtaining competitive advantage in healthcare organizations. The notion is that information technology is such an integral part of all aspects of the healthcare delivery system that no one organization benefits relative to its competition from having extensive information technology. DeFord and Porter (2005) argue convincingly that information technology infrastructure as one part of overall IM/IT is still valuable and benefits from centralization. In their opinion, centralized information technology does the following:
   • Reduces variability
   • Improves security
   • Reduces human resource requirements
   • Enhances flexibility
   • Reduces procurement costs
   • Reduces total cost of ownership
• Improves end-user satisfaction
• More effectively and efficiently aligns IM/IT to business needs
Proponents of decentralization argue that this approach places control of information systems back where it belongs—in the hands of users. Decentralization fosters innovation in system design and develops increased user interest and support. Local flexibility is maintained, and the frustrations of lengthy programming and processing backlogs at a central facility are avoided.

2. The network architecture that specifies how computers and workstations will be linked together through communication lines and network servers. Chapter 6 includes a detailed description of alternative network architecture configurations, including the following:
   • Central mainframe architecture
   • Client/server architecture
   • File/server architecture
   • Distributed processing architecture
Data distribution plans will help determine which type of network architecture should be employed by the healthcare organization. Alternatives range from creation of large, centralized (enterprisewide) “data warehouses” to complete distribution of data in which each organizational unit on the network maintains its own database.

3. The manner in which data will be stored and distributed throughout the organization, including database security and control requirements. Many healthcare organizations, particularly IDSs, are moving toward a combination of approaches to data distribution. For example, the IDS might develop a centralized data warehouse containing a master patient index and computerized records for all patients in the system. Individual organizational units (hospitals, ambulatory care centers, etc.) might maintain their own data files for patient appointments, employee records, inventory control, budgeting, and financial management. The telecommunications network supporting the system will be designed to facilitate electronic exchange of information so that patient records are accessible at all treatment sites and financial information can be transmitted to corporate offices on a periodic basis. In addition to describing the network architecture, the plan should specify how the infrastructure will support related activities such as audio, video, and wireless communications; document imaging; and radiographic imaging.

4. The manner by which individual applications will be linked so that they can exchange information. The subject of interoperability is discussed more fully in Chapter 2. This is a key strategic consideration that affects all clinical and administrative components of the delivery system.

Regardless of the approach followed for data distribution and system integration, data standards will be required. This topic is discussed in detail
later in this chapter. Data security and protection of information confidentiality is discussed in Chapter 5.

The subcommittee that reviews systems architecture must include competent technical staff and/or consultants working closely with representatives of management, the medical staff, and other major system users.

The information systems plan should also specify procedures for software development. In the early days of healthcare computing (1960s to 1980s), most hospitals and other healthcare organizations employed a staff of computer analysts and programmers to develop computer applications in-house. Today, most healthcare organizations rely primarily on software packages purchased from commercial vendors. A wide array of software products is available; see, for example, the annual resource guide published by Health Management Technology magazine, which is available online at www.healthmgttech.com. This source presents a vast listing of companies, including a brief description of the company, its product categories, and contact information.

Use of applications service providers (ASPs) is another alternative for software acquisition that is growing in popularity among healthcare organizations. An ASP is an organization that contracts with a healthcare provider to provide access to and use of applications on an off-site server on a subscription basis (Monohan 2001). Many large healthcare organizations and IDSs use combinations of these software development options. Commercial software may be combined with tailor-made programs developed by in-house staff, particularly programs that support database management and electronic communications across the network. ASPs may be used for selected applications by smaller units affiliated with the enterprise.

The IM/IT strategic plan should specify the management structure for information systems. Most healthcare organizations still employ an in-house staff for system operation and management, even if all or most software is purchased from commercial vendors or leased from ASPs.

Decisions must be made on the extent to which technical staff will be centralized or distributed among the major user departments of the organization. An increasing number of organizations are outsourcing all or some of their information-processing functions to contractors who provide on-site system implementation and management services.

Centralized staffing offers the advantages of economies of scale and reduction in the number of technical personnel to be employed. Decentralized staffing brings systems management closer to the user and offers the potential for increased support and user involvement in system development and operation.

Outsourcing of information systems functions allows the healthcare organization to get out of the information technology business through
contracting with experts in the field. However, the costs of outsourcing may be high and may tend to generate too much distance between users and technical systems specialists.

The final element of the information systems plan specifies resources required to carry it out. The capital budget should include five- to ten-year projections for the cost of computer hardware, network and telecommunications equipment, and software. The operating budget includes costs for personnel, supplies and materials, consultants, training programs, and other recurring expenses. Both budgets should be updated annually, and the timing for their preparation should be coordinated with the overall organizational budget cycle.

Although the information technology budgets for healthcare organizations lag behind those of other information-intensive industries, the Seventeenth Annual HIMSS Leadership Survey reports that budgets are increasing in an attempt to keep pace with developing technology. Seventy-two percent of the survey respondents indicated that their budgets would increase in the current year, and only 6 percent expected their budgets to decrease (HIMSS 2006).

The planning process is the subject of many other books, but for completeness of the discussion here, a “generic” planning methodology adapted from Glaser (2002) is provided in Figure 3.4. This plan starts with the necessary gathering of information to review existing organizational strategies with senior management and middle management. The goal is to identify information systems needs by contrasting existing resources with the requirements that will meet users’ expressed needs. Glaser suggests that much of the information gathering is done by external consultants.

Once the gap between needs and capabilities is determined, the next step is to delineate information systems alternatives. These alternatives will require key implementation steps to be specified, followed by estimates of resource requirements and timelines for implementation. Finally, the full plan with recommendations is presented to management.

**Review and Approval of the Information Systems Plan**

The IM/IT plan should specify an overall schedule and set of target dates for implementation. Although cost estimates and target dates will be preliminary at this point, they will assist management and board members in evaluating the magnitude of organizational commitments required to implement the recommended set of alternatives.

After the IM/IT steering committee has approved the plan, it should be presented to executive management and the governing board for their review and approval prior to implementation. The written plan should be submitted to management in advance of a formal presentation and discussion session.
As with any plan, the strategic IM/IT plan must be a dynamic instrument that is reviewed periodically and regularly updated. At least once a year, the information systems steering committee should review progress in meeting the original criteria set forth in the plan, and the plan should be changed as necessary. This review process is essential for the steering committee to monitor progress toward meeting goals and report that progress to IM/IT leadership. It may also put forward a suggestion that the organization change strategic direction should the environment change dramatically.

**End-User Computing**

A problem that many healthcare organizations face is what to do about dissatisfaction among organizational units whose information systems needs are not identified as priorities in the strategic information systems plan. End-user computing strategies offer one potential solution to this problem.

Many employees have become sophisticated in computer use. Powerful personal computer systems with user-friendly software and user-oriented programming tools have helped to facilitate end-user computing that does
not require the services or resources of the central information systems department.

End-user computing most often involves use of departmental software packages purchased from vendors (e.g., laboratory, pharmacy, radiology systems) or leased from an application service provider. In some cases, computer-literate users may write programs to meet specialized needs in their departments. An example would be end users at an outpatient clinic in a large medical center creating and maintaining a database of companies that provide medical supplies for the clinic.

End-user computing offers the potential to expand the base of IM/IT development and overcome issues that arise when a low priority is assigned to certain applications that are nevertheless viewed as important to units within the organization. End-user computing must be approached cautiously, however. Most activities in healthcare organizations are interrelated, and computer applications must be able to exchange information for efficient operations (see the next section on standards and policies). If a departmental system can stand alone, management might authorize acquisition, provided that department funds are available and the system is developed in accordance with the strategic IM/IT plan and enterprisewide standards and policies. If the system will need to exchange information with other units of the organization, central control and planning is needed before the end-user department is authorized to acquire the system. Data compatibility—use of common codes and data definitions for electronic information exchange across the organization—should be mandatory (see the following section).

**Strategic Information Systems Planning for IDSs**

IDSs must consider the need for integration of information systems across institutions as well as within individual organizational units. Such integration is particularly critical in vertically integrated organizations where patients may progress and seek treatment at various organizational components, including clinics, surgical centers, acute care hospitals, substance abuse centers, and skilled nursing facilities. Information systems must be patient centered to aggregate data from the various medical care units and track patients throughout the system. At the same time, corporate system management must recognize that different types of facilities within the organization (hospitals, ambulatory care centers and clinics, nursing homes, home health agencies) have their own distinct information requirements. Corporate policy must provide mechanisms for specialized information systems to meet the needs of individual units in the system.

Information systems for an IDS must also be able to provide comparative financial data for management to efficiently allocate resources to individual units. Such a capability is especially critical when healthcare costs are paid on a capitation basis. Corporate management will need to carefully monitor how patient care dollars are being spent across system units for actuarial risk
analysis. The IDS also will have special information needs for market research and analysis of competitor services. Physician performance in various components of the system must be monitored as well.

At the technical level, information systems for an IDS may require standardization of coding and data definition for all organizational units—for example, a common chart of accounts for financial reporting. If such an approach is not feasible, then complex data conversion tables will be required to facilitate electronic data exchange. To serve corporate management information needs and operational support requirements of each medical care unit, IDSs need to strike a balance between centralized data management and local control of data processing.

In recent years, hospitals have merged to form corporate systems, medical centers have acquired community hospitals and brought them into their organizations, and some corporate systems have sold or divested some of their existing facilities. These mergers and changes in ownership can create special problems with respect to information systems at the individual facilities.

If the corporate system has highly centralized information processing through a corporate data center and a new facility is acquired, special planning will be required to bring the new unit into the central system while allowing it to continue to use its current hardware and software to support ongoing operations. If computing within the corporate system is decentralized at the facility level, the newly acquired facility may not have compatible hardware and/or software with other units of the enterprise. Conversion programs may be required to convert data from these legacy systems to meet corporate reporting requirements. Unique information-processing problems usually result from these mergers, acquisitions, and joint ventures. Management at both the corporate and institutional levels must be prepared to address these problems as the plans for organizational change are developed.

**Transition**

Many health systems are developing data warehouses to serve the needs of facilities within their systems. Breen and Rodrigues (2001, 87) present a case study on development of a data warehouse and conclude, “Successful implementation of a data warehouse involves a corporate treasure hunt—identifying and cataloging data. It involves data ownership, data integrity, and business process analysis to determine what the data are, who owns them, how reliable they are, and how they are processed.”

The Cleveland Clinic, Cleveland, Ohio, has extended its efforts to report quality indicators by using its administrative and clinical data repository of patient data to aggregate and report physician indicators of quality. In its settings, advanced practice nurses (APNs) provide primary care to patients in the ambulatory setting, but their data are traditionally linked to the primary care provider and not to the nurse. The extension is to link patient information assembled via its electronic health record to the APN managing the patient.
In this way, quality outcomes can be reported for this vital provider group, demonstrating APNs’ contribution to patient care (Kapoor et al. 2006).

Even the federal government has developed the data warehouse concept for collection, storage, and dissemination of the vast quantity of healthcare data it manages (see the website for the National Center for Health Statistics, part of the Centers for Disease Control and Prevention, at http://www.cdc.gov/nchs/datawh.htm or the Environmental Protection Agency website at http://www.epa.gov/enviro/ for examples).

**Importance of System Integration: What**

Certain background concepts are important to an understanding of the effective application of information technology in healthcare organizations. These concepts include a review of general systems theory, key principles of management related to the development and operation of information systems, and the need for change management in adapting systems to the organizational culture.

**Systems Theory**

*Systems theory* provides the conceptual foundation on which the development of information systems is based. Healthcare managers should have a general understanding of this theory to determine how information systems function in their organizations, particularly in using information for management control. Scientists have completed considerable research on systems and how they function in all phases of our society. Interest in *general systems theory* developed in the post–World War II period. Initial research efforts were focused primarily on the physical sciences, with the study of strategic military weapons systems, systems for space exploration, and automated systems of all kinds to reduce manual labor and improve the overall quality of life.

In the 1960s, attention shifted to the application of systems theory to the social sciences, including organizational theory and management. Although much of this work is highly theoretical and of interest to those involved primarily in research, some general discussion of systems theory is a useful background for understanding management control systems in healthcare delivery and for setting forth principles of information systems analysis and design.

The systems approach is important because it concentrates on examining a process in its entirety, rather than focusing on the parts, and relates the parts to each other to achieve total system goals. Management control requires that performance be compared against expectations and that feedback be used to adjust the system when performance goals are not being met.

*Systems analysis* is a fundamental tool for the design and development of information systems. It is the process of studying organizational operations and determining information systems requirements for a given application.
Systems analysis employs concepts from general systems theory in analyzing inputs, processes, outputs, and feedback in defining requirements for an information system. The remainder of this section presents a general overview of systems theory and its application in healthcare organizations.

A variety of systems comprise the functioning of healthcare organizations. These systems can be categorized into three groups: mechanical systems, human systems, and human-machine systems. Mechanical systems are an integral part of the physical plant, serving such purposes as heating and cooling; monitoring temperature, pressure, and humidity; and supplying chilled and heated water.

Most of the essential functions of a healthcare organization are carried out through human systems—organized relationships among patients, physicians, employees, family members of patients, and others. Many of these systems are formally defined. For example, nursing care is provided in accordance with a scheduled set of predetermined protocols and procedures, and nursing service personnel are trained and supervised in the proper execution of this “system of care.” Many things also happen through informal relationships, which often become well defined and known to those in the organization. Thus, certain activities get accomplished by “knowing the right person” or sending informal signals to key individuals about actions that need to be taken.

With the development of modern information technology, many systems fall into the third category, human-machine systems. These are formally defined systems in which human effort is assisted by various kinds of automated equipment. For example, computer systems have been developed to continuously monitor the vital signs of critically ill patients in intensive care units of medical centers.

Information systems in healthcare organizations fall into the second and third categories of this simple taxonomy; that is, information systems will be either human systems or human-machine systems designed to support operations. Information systems that operate without any type of machine processing of data are referred to as manual systems. Although much of this book deals with computer-aided information processing, most of the principles set forth here, particularly those dealing with systems analysis and design, apply equally to the development of manual systems for processing information.

Healthcare organizations also can be described in a broader context. Figure 3.5 is a systems diagram for a healthcare organization that shows the relationships among various inputs and environmental factors as these factors influence the provision of services to the community. In this context, mechanical, human, and human-machine systems would constitute elements, or subsystems, of the conversion process.

**Systems Characteristics**

Certain basic concepts are central to a general understanding of systems and how they function. These are presented in the following paragraphs.
FIGURE 3.5
The Healthcare Organization as a System

Environmental influences
Social, economic, political

Conversion process
Organizing inputs into a set of formal and informal procedures for the delivery of services

Feedback cycle

Inputs
1. Needs and demands for health services determined through planning, analysis, evaluation, and special interest advocacy
2. Resources required to provide services, including manpower, capital, operating funds, and necessary technology
3. Behavioral variables (individual and cultural) that affect utilization
4. Payer values that determine and limit available resources
5. Community values
6. Formal regulations imposed by external authorities
7. Administrative invention (spontaneity and creativity)

Outputs
1. Specific services rendered to clients and related outcomes of these services
2. Evaluation of services rendered and related plans for new and modified services
3. Symbolic messages to the clientele and community at large through attitudes, gestures, and statements of those providing the services

Environmental influences
Social, economic, political

Conversion process
Organizing inputs into a set of formal and informal procedures for the delivery of services

Feedback cycle
A system must have unity or integrity. A system must be something that can be viewed as an entity in its own right, with unity of purpose in the accomplishment of some goal or function. A system must have an identity and must have describable boundaries that allow it to be defined without reference to external events or objects.

Systems at work in healthcare organizations are, for the most part, very complex. The intricate web of complex relationships that constitute most social systems often makes it difficult to describe simple cause-and-effect relationships among individual components of the system. The phenomenon of system complexity is often described by stating that a system is more than the sum of its parts.

Complex systems are further defined by their hierarchical structure: Large systems in healthcare organizations can be divided into several subsystems, and these subsystems in turn are subject to further subdivision in a nested format. For example, the patient care component of an integrated delivery system is composed of several subsystems—a diagnostic subsystem, a therapeutic subsystem, a rehabilitative subsystem, and so forth. Each of these subsystems in turn can be further described by a series of smaller systems. The entire network of systems and subsystems nests together in a structured way to describe the patient care system of the organization (see Figure 3.6).

**FIGURE 3.6** Healthcare Organization Systems Network
Although most organizational systems are dynamic and subject to frequent change, they nonetheless must possess some stability and equilibrium. The system must continue to function in the face of changing requirements and changes in the external environment in which it operates. To accomplish this, procedures must be sufficiently generalized to accommodate a variety of situations that can be expected to develop. Complex systems must be self-adapting and must include control functions that are continuous and automatic. When the system can no longer adapt to changing requirements or major changes in the external environment, it no longer functions as a system and breakdown has occurred.

Systems can be either deterministic or probabilistic. In a deterministic system, the component parts function according to completely predictable or definable relationships. Most mechanical systems are deterministic. On the other hand, human systems or human-machine systems (including information systems) are probabilistic because all relationships cannot be perfectly predicted. In healthcare organizations, for example, most clinical systems are subject to fairly extreme fluctuations in the quantity and nature of the demand for patient services. Systems theory, then, provides a perspective—a way of viewing not just the parts, not just the whole, but the spectrum of relationships of the parts viewed in the context of the unitary purposes of the system as a whole.

The simplest of all systems consists of three essential components: one or more inputs, a conversion process, and one or more outputs (see Figure 3.7). Consider, for example, the appointment-scheduling process of an ambulatory care center as a simple system. Inputs to the system consist of appointment requests from patients; physician schedules; and clinic resources, including personnel, treatment rooms, and supporting materials. The conversion process includes a set of actions: the scheduling clerks collect information from patients, match patient requirements to available time slots, and make appointments. Output of this simple system consists of patients scheduled for service in the clinic. Note that the output of this system becomes the input for several other functional systems of the clinic—medical records, patient accounting, and others.

Most systems also involve feedback. Feedback is a process by which one or more items of output information “feeds back” and influences future inputs (see Figure 3.8). In the example just cited, feedback will occur in the form of adjusted information on the number of time slots available as patients are scheduled for the clinic. Each time an appointment is made, input data on times available are revised and updated.
Systems are either open or closed. A closed system is completely self-contained and is not influenced by external events. In an open system, the components of the system exchange materials, energies, or information with their environment (see Figure 3.9); that is, they influence and are influenced by the environment in which they operate. All closed systems eventually die (cease to function as a system). Only open systems that adjust to the environment can survive as systems over time.

Environmental Factors in Open Systems

Healthcare systems, with the exception of certain purely mechanical systems in the physical plant, fall into the category of open systems. Human or human-machine systems in healthcare organizations are influenced by a variety of environmental factors (sometimes referred to as exogenous factors or variables) that are important to consider in understanding how a system functions. These environmental factors fall into four broad categories: social, economic, political, and physical environment.

Healthcare systems are influenced by social factors—characteristics of individuals and groups of people involved in the transactions that organizations undertake. Social factors affect patient behavior and patterns of utilization of services. Informal patterns of behavior develop among employees, and these have definite effects on the way operating systems function. The organizational roles played by physicians and other health professionals interact with the formal functioning of healthcare systems. Social factors are important determinants of system functioning, and systems analysts need to be well versed in the art of human-factors engineering when designing systems.

A second major category of environmental factors is economic in nature. Systems are directly dependent on the availability of resources, and fluctuations in the local and national economy will influence both demand and resources. It is well known, for example, that elective procedures are often deferred by patients during times of economic recession.

Healthcare systems are also affected by political factors. A variety of special interest groups place competing demands on healthcare organizations, and systems are influenced both by community politics and by organizational politics. These political realities must be considered in the analysis and design of systems for the institution.
The physical environment constitutes the final category of environmental factors affecting organizational systems. The amount of space available and the way in which system components relate physically to each other will influence the effectiveness of a system.

To summarize briefly, healthcare systems are open systems influenced by a variety of social, economic, and political factors and by the physical environment within which they function.

**Cybernetic System**

The final concept to be introduced in this brief review of general systems theory is the concept of a cybernetic, or self-regulating, system (Weiner 1954). Feedback in a cybernetic system is controlled to adjust the future functioning of the system within a predetermined set of standards. The following components are added to the general system components to provide this automatic control:

1. A **sensor** element continuously gathers data on system outputs.
2. Data from the sensor are fed into a **monitor** for continuous matching of the quantity or quality, or both, of performance against **standards**—predetermined expectations of system performance.
3. Error signals from the monitor are sent to a **control unit**, whose purpose is to generate correctional signals that automatically modify inputs and conversion processes to bring the functioning of the system back into control.

The most often cited example of a cybernetic system is a thermostatic control system for the automatic heating and cooling of a building. The sensor unit continuously measures ambient temperature and sends signals to the monitor, which compares the current temperature to preset standards. Through the control process, automatic correction signals are sent back to the

![FIGURE 3.9
Open System Diagram](image-url)
heating/cooling units of the system to keep the temperature within control limits.

**Management Control and Decision Support Systems**

Organized systems in healthcare organizations should be designed as cybernetic systems with formal management controls built in as an integral part of the design. The inputs to this generalized system include the demand for services by patients and those who represent them and the resources required to provide services such as labor, materials, capital, and technology. The conversion process consists of actions taken by employees of the healthcare organization aided by formalized procedures, informal patterns of functioning, and supporting equipment. System outputs include the services rendered to patients and the specific patient and community outcomes related to these services.

Management control is introduced in cybernetic components of the system (see Figure 3.10). The sensor component continuously gathers data on the quantity of services rendered, the quality and other characteristics of these services, and the resources consumed in their provision. Data from the sensor (management reports) are monitored against the standards, established in advance, of quantity (production and service goals), quality of care, efficiency of the service process, and patient outcomes. When standards are not met, a control process is activated to initiate necessary changes and improvements. The control process contains several components, including education and training of personnel, community education programs, reengineering of the process of care, personnel changes to improve service, utilization of employee incentives, initiation of disciplinary action, and many others.

A key component in the establishment of management control systems is the establishment of standards for performance and quality control. The task of developing standards is not an easy one and requires considerable effort and thoughtful planning among managers and professional personnel practicing in or employed by the healthcare organization. Standards can be developed in a number of ways. They may be established by administrative or medical authority in the institution. In some cases, they may be developed through negotiation and subsequent agreement between employees and supervisors. Empirical studies of previous performance, using industrial engineering techniques, offer another approach to standards setting. In certain areas of operation, standards are mandated by external regulations, legal requirements, or accrediting agencies.

Whatever the approach to the development of standards for healthcare systems, standards are essential to avoid management control that operates on an ad hoc basis. Standards require careful management planning, continual review and revision, and frequent reinforcement through incorporation into the formal reward system. They are essential to effective management control.
As an example of these concepts, the operation of a centralized clinical laboratory in an integrated delivery system can be described as a cybernetic system with planned controls built into the system for quality assurance and performance-control purposes. Figure 3.11 is a schematic diagram describing the functioning of the laboratory in system terms.

System inputs include scheduled demand (laboratory tests planned, ordered, and scheduled in advance) and unscheduled demand (tests required to be processed on an emergency, or stat, basis). Resource inputs include technical personnel in the laboratory, materials and equipment used in the testing process, and related technology. The conversion process consists of those formal and informal organizational actions related to collecting specimens; conducting laboratory tests; and reporting results to appropriate points in the hospitals, outpatient clinics, and other service units of the IDS. System outputs include the test reports sent back to clinicians ordering the tests, charges for services transmitted to the patient accounting department for billing purposes, and various statistical reports.

Cybernetic components for management control are also included. The sensor component is the management reporting system of the laboratory by which data on the number of tests conducted by various categories, quality control data, and records of resources consumed (including personnel time
of laboratory technicians) are collected and recorded. These data are used by laboratory managers who monitor actual performance against predetermined standards, including those established by The Joint Commission, professional standards of quality established by the chief pathologist and medical staff, and cost and efficiency (productivity) goals established jointly by the administrative and medical personnel in the organization. When standards are not met, corrective actions are initiated, including activation of continuing education and retraining; revision of operating policies and procedures, including recalibration of test equipment if necessary; change in staffing patterns and scheduling; and the like. The laboratory operates overall as an open system influenced by several contextual or environmental factors, including the physical environment of the laboratory facility, current economic conditions of the IDS, social
and political factors related to interaction of personnel in the laboratory, and 
the advancement of technology.

**Information for Management Control**

Any management control system is information dependent. Information re-
quirements permeate the system diagrams presented in the preceding parts 
of this chapter. For health programs to be properly managed, information is 
needed about each of the major system components previously described.

Input information must be collected to monitor demand continuously, 
both scheduled and unscheduled, as well as the resources consumed in the 
provision of services. Operational procedures must be constantly observed 
through information on exceptions, error rates, system malfunctions, and sim-
ilar performance measures on a management-by-exception basis. Output in-
formation on the quantity and quality of services rendered must be matched 
with information on related outcomes of the provision of specific services. In 
addition, the effective manager must keep in close contact with the environ-
ment in which his or her department or institution functions. Environmental 
information—such as demographic characteristics of the service population, 
previous utilization patterns, services offered by other organizations, and re-
cent changes in community values—is essential to this task. An effective infor-

What, then, are the attributes of information useful for management 
control in the delivery of healthcare? Some of the more important charac-
teristics of effective management information are listed in Figure 3.12 and 
discussed below.

**Characteristics of Useful Information**

The first, and perhaps most essential, characteristic is that information, to be 
useful, must contain *information, not just raw data*. Data must be intelligently 
processed in accordance with predesigned plans before it becomes information 
useful to management or operating personnel.

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**FIGURE 3.12**

Characteristics of Useful Management Information

- Information—not data
- Relevant
- Sensitive
- Unbiased
- Comprehensive
- Timely
- Action oriented
- Uniform (for comparative purposes)
- Performance targeted
- Cost effective
Health information must be relevant to the purposes for which it is to be used. It must be sufficiently sensitive to provide discrimination and meaningful comparisons for operating managers. Many information systems provide data that are so aggregated that they provide no meaningful indicators for management planning or control purposes. Overall hospital cost per patient day is a good example. By contrast, separating costs into fixed and variable components and allocating variable costs by diagnostic groupings and level of care provide more useful information to management.

Useful information must be unbiased and not collected or analyzed in such a way that it meets self-fulfilling prophecies. Information should be comprehensive so that all elements or components of a system are visible to those responsible for administering that system.

Information must be timely, presented to users in advance of the time when decisions or actions are required. Many information systems produce beautiful reports that are completely useless because of failure to meet operational time requirements. Information should be action oriented, designed to aid the manager directly in the decision process rather than just to present passive facts about current operations. For example, information from an inventory control and materials management system should include direct indicators of when specific items need to be reordered rather than just give data on current numbers in stock.

Information systems should have as their goal the production of uniform reports so that performance indicators can be compared over time both internally against previous performance and externally against the experience of other comparable organizations. Good information will also be performance targeted, designed and collected in reference to predetermined goals and objectives of the institution. Finally, information should be cost effective. The anticipated benefits to be obtained from having the information available should be worth the costs of collecting and processing that same information.

Importance of Systems Integration: Why

System integration is one of the most important objectives of strategic IM/IT planning. Healthcare delivery generally involves a wide range of providers. While much of that care provision used to occur primarily in a hospital or in a physician’s office, today, care is provided in many settings by many providers. Getting these diverse groups to coordinate care has been a challenge because of geographic and organizational separation. For optimum care, these organizations must become more highly interconnected.

The first challenge is for units of the organization to communicate with one another and share clinical information. Clinicians need information that is generated by several different departments (radiology, pathology, etc.) to make diagnostic and treatment decisions. Mixing of clinical and financial information is essential for effective management and strategic decision support.
Internal communication and sharing of information is only half the battle. The concept of system integration has expanded from the need for connecting within an organizational entity to connectivity across organizations (Markle Foundation 2004). Healthcare organizations need to be connected externally for both business and regulatory reasons. The federal government’s mandate for interoperability has raised the urgency for system integration and has led to the establishment of the Certification Commission for Healthcare Information Technology (CCHIT). This commission is charged with creating standards by which healthcare organizations can communicate information. It is thought that government standards will force vendors to develop software that meets interoperability requirements. In addition, the connectivity must include business partners for healthcare organizations and all other providers in an integrated delivery network. For example, Figure 3.13 represents a schematic diagram of the information requirements for a truly integrated delivery system (Markle Foundation 2004).

Oas (2001) states that system integration has been slow in coming to healthcare. Information systems developed in the 1980s focused on billing and business office functions. Most of these systems contained limited clinical information. In the 1990s, emphasis shifted to automation of clinical processes and provision of access to clinical data to individuals across the enterprise. Seamless integration and information sharing is essential in today’s environment. However, much has yet to be done to achieve this. CCHIT Chair Mark Leavitt indicated that providers in the healthcare field still have limited ability for any two member entities to exchange information (Robeznieks 2006).

Achieving system integration requires careful front-end planning prior to the selection and acquisition of computer hardware and software. Some of the technical aspects of data and software integration are discussed elsewhere in the book. The planning processes described in the remainder of this chapter are essential to help ensure that systems are connected for information sharing across the organization.

The business case for integration stems from the vital role that comprehensive information has on clinical and administrative decision making. The potential for computerized physician order entry (CPOE) to reduce medical errors rests firmly on IM/IT capacity and integrated medical, nursing, and pharmacy systems (see Hillestad et al. 2005 and Johnston et al. 2003 for general discussions and findings regarding CPOE). Strategic growth through fully utilizing the joint inpatient, ambulatory, and physician practices relies upon seamless information flows among and between these entities. Finally, the new movement to regional health information networks (RHIOs) will require access to and sharing of clinical and financial information among organizations. Investing in the capacity of organizations to share clinical and financial information is occurring in an era of significant cost constraints for healthcare and IM/IT.
FIGURE 3.13
Information Requirements for an Interconnected Network

Summary

IM/IT governance has expanded in scope and importance along with the growing integrative role of health information in healthcare organizations. Healthcare organizations that successfully implement IM/IT must have a governance structure that effectively (1) develops a consistent IM/IT strategy; (2) aligns IM/IT with organizational strategy; (3) develops IM/IT infrastructure, architecture, and policies; (4) sets IM/IT project priorities and oversees investments in IM/IT infrastructure; and (5) uses IM/IT benefits assessment to enhance accountability.

To attain that success, organizational leadership must formulate an IM/IT plan that is linked to the strategic plan of the organization. The plan should include (1) a statement of information systems goals and objectives aligned with organizational goals and priorities; (2) a list of priorities for the computer applications portfolio (clinical, management/administrative, electronic networking and e-health, and strategic decision support); (3) specification of overall system architecture and infrastructure; (4) a software development plan; (5) an information resources management plan; (6) a statement of resource requirements, including projected capital and operating budgets; and (7) schedules and target dates for implementation of various elements of the plan.

The planning process should be guided by an enterprisewide information systems steering committee with membership from senior management, medical staff, nursing staff, financial management, human resources management, planning and marketing, facilities management, and clinical support services. The CIO should chair the committee if the healthcare organization has established such a position.

System integration—that is, the ability of information systems to communicate with one another and share information—is essential. Integration can be achieved through a number of alternative information network architecture configurations, including a central mainframe approach, client/server architecture, file/server architecture, and distributed processing.

The planning process should include development of major institutional policies related to information systems. The information systems steering committee should oversee policies related to data security, privacy, and confidentiality; data standardization; acquisition of hardware, software, and telecommunications network equipment throughout the enterprise; and policies on use of the Internet.

An understanding of general systems theory is useful for healthcare managers in designing and developing management control systems and in obtaining the kinds of information that are required to enable such systems to function effectively. Healthcare systems are characterized as “open systems.” These are influenced by the environment in which they function, and they exchange information with that environment. Key environmental factors include
political, social, and economic variables that influence system performance as well as the physical environment in which the system functions. Healthcare systems are also considered “cybernetic systems” if they include formally planned components that introduce automatic control into the systems. Cybernetic components include sensors to gather data on current system functioning; monitors to compare these data against predetermined standards; and control elements to change inputs or process, or both, when system functioning is out of control. Management control systems in healthcare organizations can be designed according to principles of cybernetic system theory.

Healthcare delivery viewed in a systems context is information dependent. Effective information for management control purposes has several important characteristics, including relevance, sensitivity, objectivity, comprehensiveness, timeliness, action orientation, uniformity, performance targeting, and cost effectiveness. Good information systems are developed with these characteristics constantly on the minds of those charged with design and implementation.

Web Resources


For diverse examples of hospital and healthcare organization information technology strategic plans, including guidelines and templates available from associations and vendors, see the following:

- The Joint Commission provides a detailed template for information management planning and broader strategic planning at http://www.olcsoft.com/IM_Strategic_Plans_for_JCAHO.htm.
- Stanford University Medical Center has made available details of its IM/IT strategic plan and planning process at http://medstrategicplan.stanford.edu/retreat03/IRT.ppt.
- Consulting firm jjwild provides a case study involving many of their clients, including Johnson Medical Center, at http://www.jjwild.com/resources-casestudies.html.
- Strategic Plan for the University of Medicine and Dentistry of New Jersey, http://informatics.umdnj.edu/iaims/pdf/Strategic_Plan_20.PDF.

For more information on the HL7 project, go to www.hl7.org.
The American National Standards Institute (ANSI) (www.ansi.org) X.12 Group is working on specifications for transactions involving the processing of health insurance claims.

The resource guide published by *Health Management Technology* magazine (available online at www.healthmgttech.com) contains a vast array of vendors organized by function.

**Discussion Questions**

1. With the change in the definition of IM/IT governance, why is the external focus of healthcare IM/IT orientation important?
2. What factors should be considered when developing a consistent IM/IT strategy?
3. Should the IM/IT strategy be developed with the IM/IT department in mind and then aligned with the organization, or should the IM/IT strategy be developed with the organizational strategy in mind?
4. Why is data standardization becoming increasingly important in healthcare?
5. Several reasons for central review of software and hardware standards were presented. What other ways would central review assist the organization?
6. The need for a master plan for information systems development was discussed. What factors/concepts should be included in this plan?
7. What would be the functions of the individuals in the steering committee, such as medical, nursing, financial management, human resources management, facilities management, and clinical support services staff? Why is it important to have all these areas represented on the steering committee?
8. There are several reasons to prefer centralized computing over decentralized computing, and vice versa. Which would you prefer, and why?
9. What are your opinions on end-user computing? What are the advantages and disadvantages?
10. What is the importance of data warehouses/clinical data repositories?
11. Give five different examples of simple systems and include the input(s), conversion process, and output(s). Ensure that there is some feedback between your examples.
12. Why do closed systems eventually die, while open systems may continue to be upgraded and modified?
13. Find examples of the use of cybernetic systems in healthcare, other than the examples provided.
14. What other challenges exist with systems integration between/among healthcare organizations? What are the solutions to these problems?
15. Find two RHIOs currently in existence. Provide an overview of each RHIO and then determine the differences between them.

16. What governance challenges do RHIOs pose for healthcare organizations in general and specifically for healthcare IM/IT?

References


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