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Health and Human Services' Office of the Chief Technology Officer (see https://healthdata.gov/content/about) has information from nearly 4,000 healthcare-related data sets from across government agencies. This repository enables users to select vast quantities of health information by topic (e.g., health behavior, disabilities), geography (e.g., state), or initiative (e.g., Healthy People 2020, County Health Indicators). Similarly, the Healthcare Data and Analytics Association (www.hdwa.org) was created to facilitate the use of health data to control costs, improve quality, and improve patient satisfaction and quality.

Importance of System Integration

The What

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

Systems Theory

Systems theory is the 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 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.

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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 to define 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 compose 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 human 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. Because of the development of modern IT, many systems fall into the third category of *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 monitor the vital signs of critically ill patients in intensive care units of hospitals or medical centers continuously.

HIT falls into the second and third categories of this simple taxonomy; that is, information systems are 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 manual systems for information processing.

A healthcare organization can be described in a systems context as well. Exhibit 4.5 is a systems diagram for a healthcare organization; it shows the relationships among and between 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 constitute elements (or subsystems) of the conversion process.

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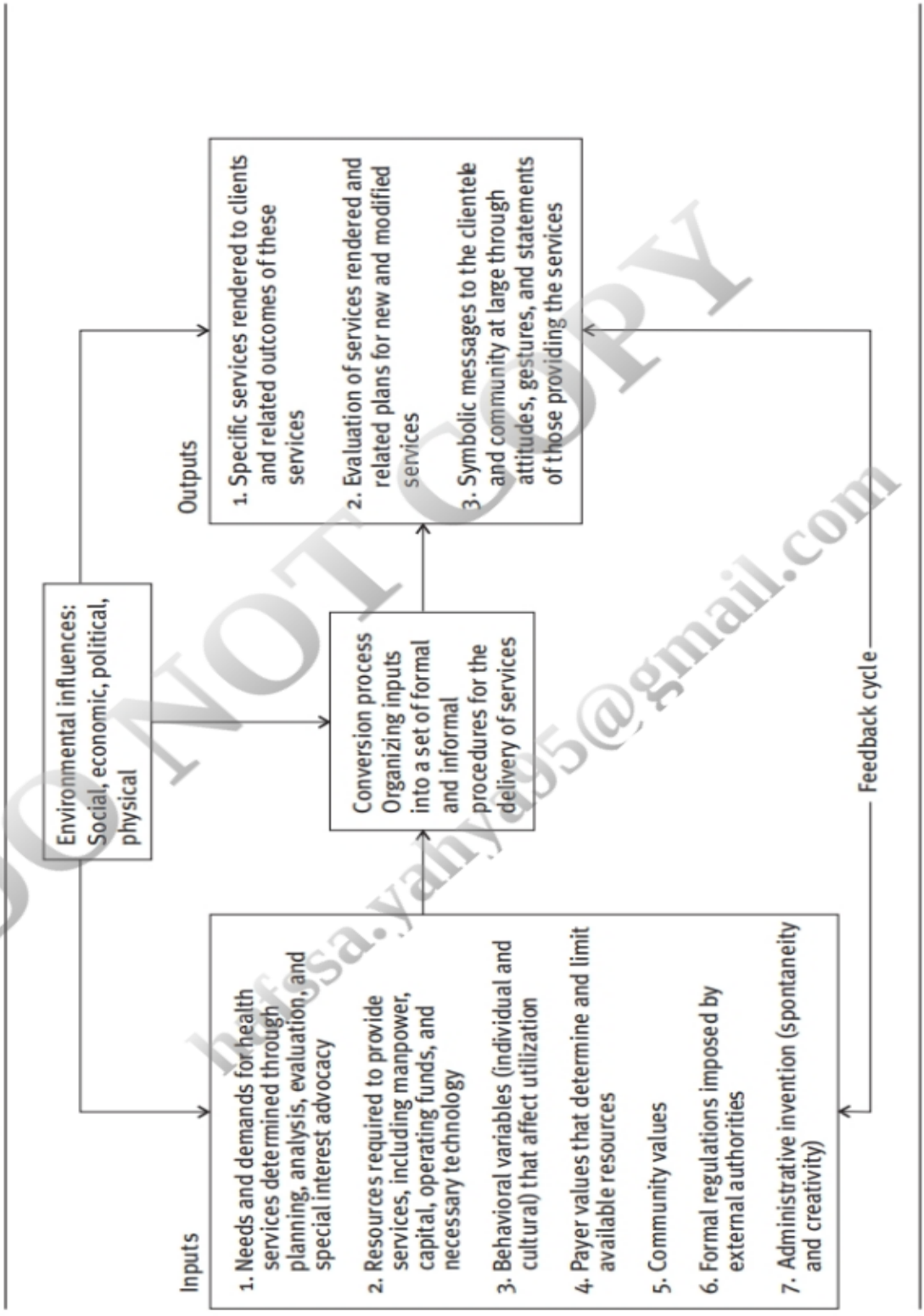
EXHIBIT 4.5
The Healthcare Organization as a System



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Systems Characteristics

Certain basic concepts explain what systems are and how they function:

- *A system must have unity or integrity.* A system must be viewed as an entity in its own right; it has a unity of purpose—the accomplishment of a 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, mostly, very complex.* The intricate web of complex relationships that constitute most social systems often makes describing the simple cause-and-effect relationships among individual system components difficult. System complexity is often described as a by-product of a system being 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 IDS is composed of several subsystems—diagnostic, therapeutic, rehabilitative, and so forth. Each of these subsystems can be further delineated by a series of smaller systems. The network of systems and subsystems of a patient care system has a nested structure (see exhibit 4.6).

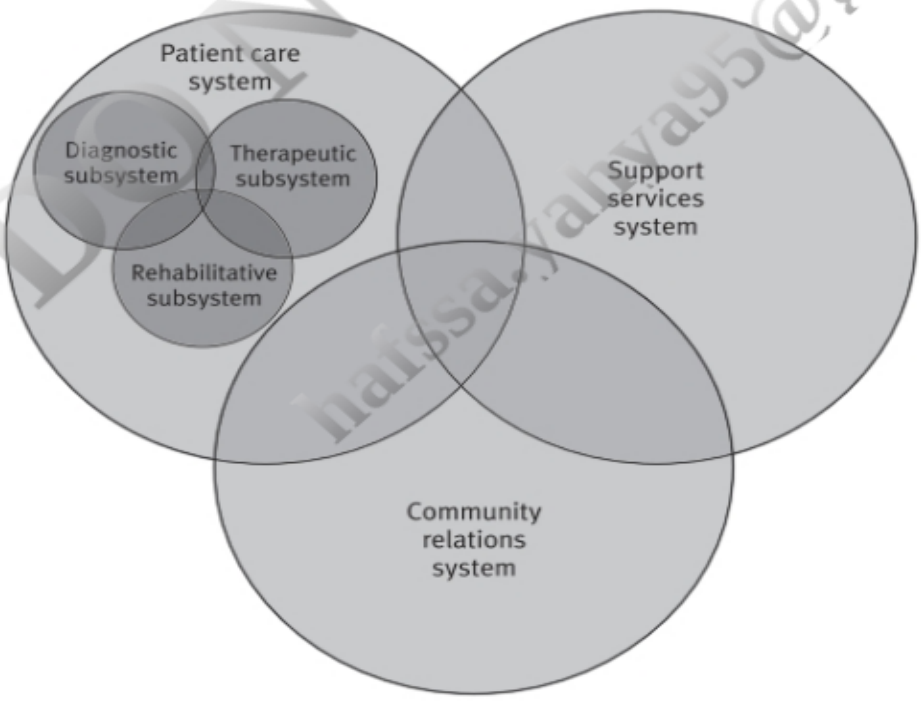

EXHIBIT 4.6 Healthcare Organization Systems Network

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- *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 the changing external environment in which it operates. To accomplish this, procedures must be sufficiently generalized to accommodate a variety of situations that could 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 external environment, it no longer functions as a system—a 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, a human systems or human–machine systems (including an information system) is probabilistic because all of its 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 and not just the whole but the spectrum of relationships of the parts in the context of the entire system's unity of purpose.
- *The simplest of all systems consists of three essential components: one or more inputs, a conversion process, and one or more outputs* (see exhibit 4.7). Consider, for example, the 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* comprises a set of actions: the scheduling clerks collect information from patients, match patient requirements to available time slots, and make appointments. The *output* of this simple system is the patient scheduled for service in the clinic. Note that the output becomes the input for several other functional systems of the clinic, such as medical records and patient accounting.
- *Most systems involve feedback. Feedback* is a process by which one or more items of output information feed back into and influence future inputs (see exhibit 4.8). In the previous example, feedback is in the form of adjusted information on the number of time slots available as the patient is scheduled for service in the clinic. In other words, each time an appointment is made, input data on times available are revised and updated.

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- *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 exhibit 4.9); that is, an open system influences and is influenced by the environment in which it operates. All closed systems eventually die (cease to function as a system). Only open systems that adjust to the environment can survive as systems in the long term.

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.

EXHIBIT 4.7
Diagram of a Simple System

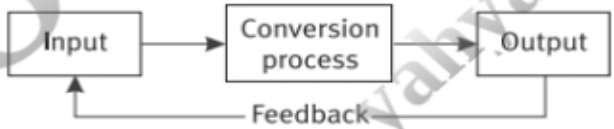

EXHIBIT 4.8
Simple System with Feedback

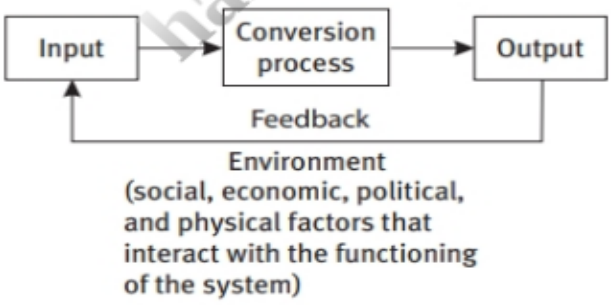

EXHIBIT 4.9
Open System Diagram

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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 service utilization. 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 is *economic factors*. Systems are directly dependent on the availability of resources, and fluctuations in the local and national economy influence both demand and resources. It is well known, for example, that patients often defer elective procedures during a recession. Healthcare systems are also affected by *political factors*, the third category. A variety of special interest groups place competing demands on healthcare organizations, and systems are influenced by both community politics and organizational politics. These political realities must be considered in the analysis and design of any system for the institution. The *physical factor* constitutes the fourth and final category that affects organizational systems. This tangible environment refers to the amount of space available and the way in which system components relate physically to each other.

Cybernetic System

A cybernetic system is self-regulating (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 are added to the system components to enable automatic control:

1. A sensor continuously gathers data on system outputs.
2. Data from the sensor are fed into a monitor to continuously match the quantity or quality (or both) of performance with the standards—predetermined expectations of system performance.
3. Error signals from the monitor are sent to a control unit, whose purpose is to 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 thermostat 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 with the preset standards. Through the control process, automatic correction signals are sent back to the heating and cooling units to keep their temperature within control limits.

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Bielecki and Nieszporska (2019) provide a current and extensive overview of a variety of health systems models and demonstrate the value added of a cybernetic perspective for analyzing the "pathology" inherent in each of the models. The systems span the range from the a simple US healthcare system with insurance engagement; a German model with centralized funding but health funds operating as insurers; a fully centralized model of healthcare provision, such as Poland; and a hypothetical participatory model. Cybernetic analysis clearly identifies conflicts and inefficiencies in each model.

Management Control and Decision Support Systems

Organized systems in healthcare organizations should be designed as cybernetic systems, which have built-in formal management controls. The inputs include the demand for services by patients and their representatives (e.g., family members) and the resources required to provide the services (e.g., labor, materials, capital, technology). The conversion process consists of actions taken by employees and other clinicians aided by formal procedures, informal patterns of functioning, equipment, and management. The outputs include the services rendered and the specific outcomes or impact of the services provided.

Management control in a cybernetic system is presented in exhibit 4.10. The sensor continuously gathers data on the quantity, quality, and

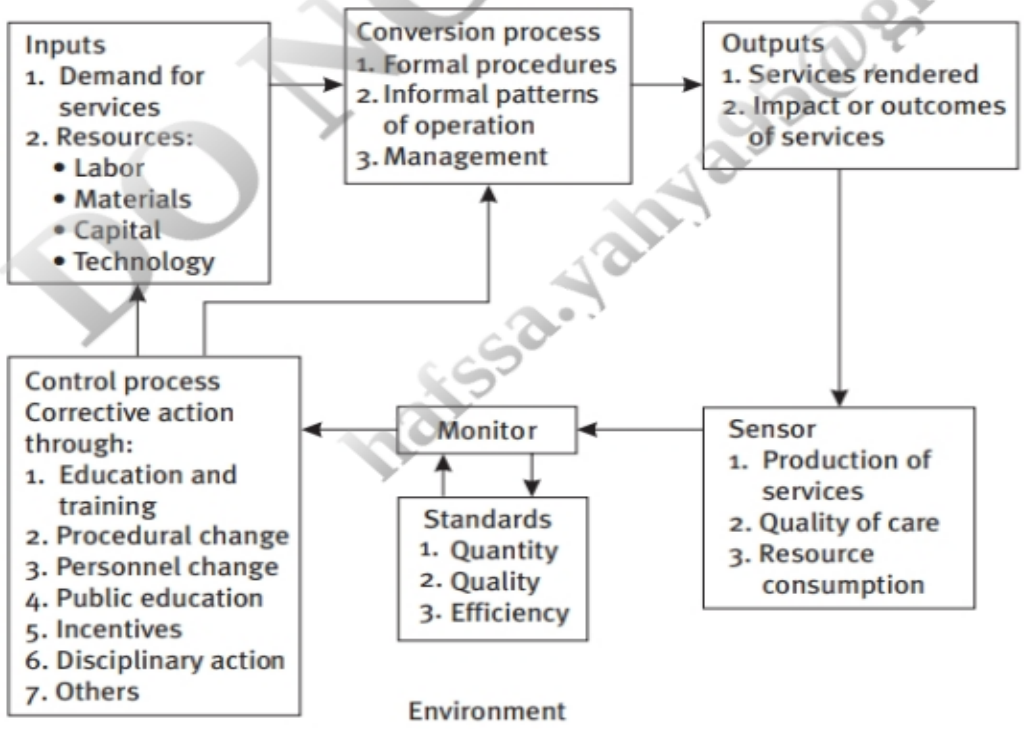

EXHIBIT 4.10 Cybernetic Management Control System for a Healthcare Organization

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other characteristics of the services rendered as well as the resources consumed in the provision of these services. Data from the sensor (i.e., management reports) are monitored against the established standards 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 or public education, reengineering of the care process, personnel changes to improve service, employee incentives, disciplinary action, and many others.

A key component in management control systems is the establishment of standards for performance and quality control. This task is not easy, requiring considerable effort and thoughtful planning from managers and professional personnel practicing in or employed by the healthcare organization. Standards can be developed or emerge in a number of ways. First, the administrative or medical authority in the institution may take the lead in the process. Second, the standards may be the result of negotiations and subsequent agreement between employees and supervisors. Third, the organization may conduct empirical studies of previous performance, using industrial engineering techniques, to determine the best standards to follow. Fourth, in certain areas of operation, standards are mandated by external regulations, legal requirements, or accrediting agencies.

Whatever the approach to or circumstances of establishing standards, healthcare organizations must realize standards are essential to effective management control. Standards prevent management control from operating on an ad hoc basis, and they require careful management planning, continual review and revision, and frequent reinforcement through incorporation into the formal employee reward system.

Consider as an example the operation of a centralized clinical laboratory in an IDS that can be described as a cybernetic system with planned controls built into the system for quality assurance and performance control purposes. Exhibit 4.11 is a schematic diagram of the functioning of the laboratory in cybernetic system terms.

System inputs include scheduled demand (i.e., laboratory tests planned, ordered, and scheduled in advance) and unscheduled demand (i.e., tests required to be processed on an emergency 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

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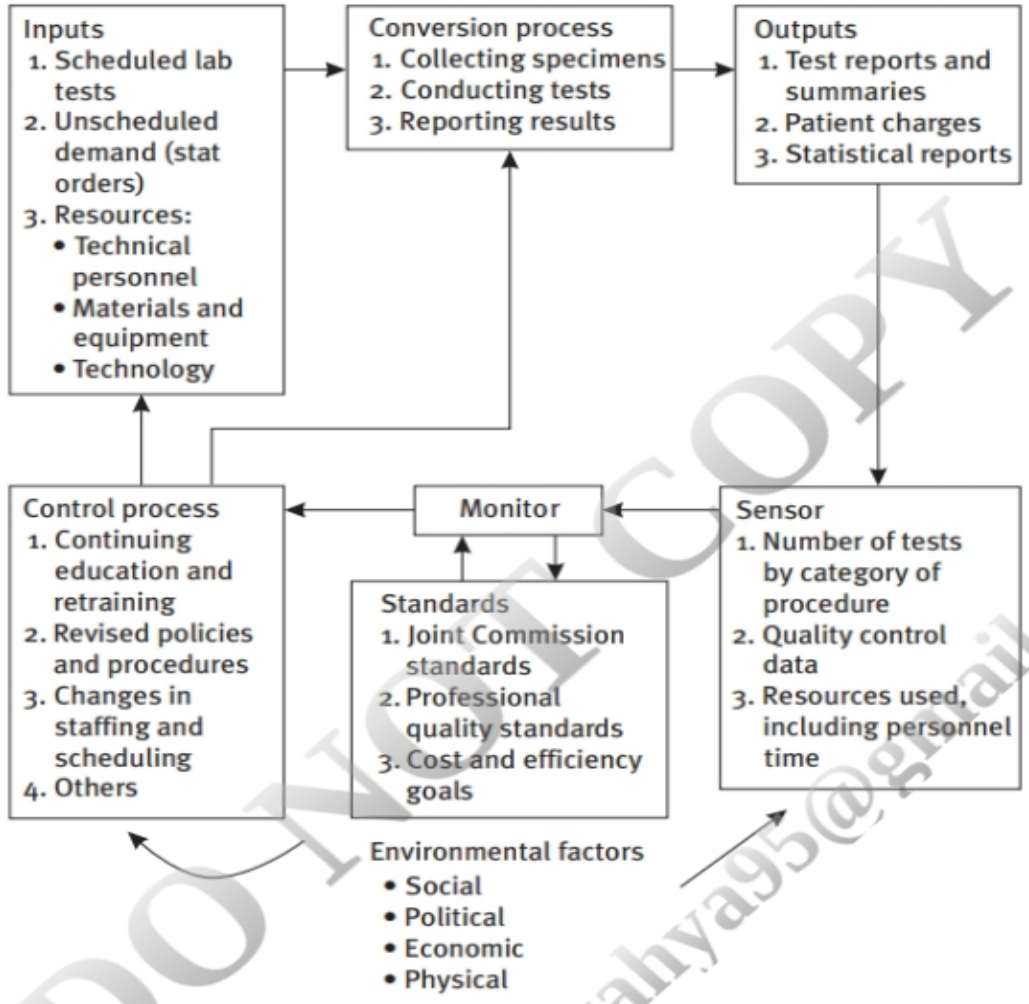

EXHIBIT 4.11 Clinical Laboratory as a Cybernetic System

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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 accrediting and oversight agencies, professional standards of quality established by the chief pathologist and medical staff, and cost and efficiency (productivity) goals established

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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; and change in staffing patterns and scheduling. 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 personnel interaction in the laboratory, and advancement of technology.

Useful Information for Management Control

Any management control system is information dependent. Information requirements permeate the system diagrams presented in the preceding exhibits. For healthcare programs to be properly managed, information is needed about each of the major system components.

Input information must be collected to monitor continuously both scheduled and unscheduled demand 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 similar performance measures on a management-by-exception basis. Output information on the quantity and quality of services rendered must be matched with information on related outcomes of the specific services provided. In addition, the effective manager must keep in close contact with the environment in which their department or institution functions. Environmental information—such as demographic characteristics of the service population, previous utilization patterns, services offered by other organizations, and recent changes in community values—is essential to this task. An effective information system is designed with these kinds of management information needs in mind.

What, then, are the attributes of information that are useful for management control in the delivery of healthcare? Some of the more important characteristics of effective management information are listed in exhibit 4.12 and explained as follows:

- *Information must contain information, not just raw data.* Data must be intelligently processed in accordance with predesigned plans before they become information useful to management or operating personnel.
- *Information must be relevant to the purposes for which it is to be used and must be sufficiently sensitive.* This kind of information enables distinction among similar or competing variables and meaningful comparisons for operating managers. Many information systems provide data that are so aggregated that they provide no meaningful indicators for management

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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.

- *Information must be unbiased.* This means information must not be collected or analyzed in such a way that it becomes a self-fulfilling prophecy.
- *Information should be comprehensive.* In this way, all elements or components of a system are visible to those responsible for administering that system.
- *Information must be timely.* It must be presented to users in advance of the time when decisions or actions are required. Many information systems produce beautifully prepared reports that are completely useless because of their failure to meet operational time requirements.
- *Information should be action oriented.* It should be designed to aid the manager directly in the decision process rather than merely 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 data on current numbers in stock.
- *Information systems should have the goal of producing uniform reports.* This way, performance indicators can be compared over time—both internally against previous performance and externally against the experience of similar organizations or competitors.
- *Information must be performance targeted.* It must be designed and collected in reference to predetermined organizational goals and objectives.
- *Information should be cost-effective.* The anticipated benefits of having the information available should be worth the costs of collecting and processing that information.

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- Information—not data—driven
- Relevant and sensitive
- Unbiased
- Comprehensive
- Timely
- Action oriented
- Uniform (for comparative purposes)
- Performance targeted
- Cost-effective

EXHIBIT 4.12 Characteristics of Useful Management Information

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The Why

Why is system integration one of the most important objectives of HIT strategic planning? Healthcare delivery involves a wide range of providers. Much of that care used to be given primarily in a hospital or in a physician's office, but today, care is provided in many settings by many providers. Getting these diverse groups to coordinate care is a challenge because of geographic and organizational separation. For optimum care, organizations must become highly interconnected.

The foremost challenge in realizing this highly interconnected ideal is getting the disparate units in the organization to communicate with one another and share clinical information. To make diagnostic and treatment decisions, clinicians need information that is generated by several different departments (e.g., radiology, pathology). Connecting clinical and financial information is essential for effective management and strategic decision support. The government has a useful but abstract framework for understanding exchange (see www.healthit.gov/topic/health-it-and-health-information-exchange-basics/what-hie). In their framework, there are three primary forms of health information exchange:

1. *Directed exchange* supports coordinated care by sending and receiving "secure information" electronically among care providers.
2. *Query-based exchange* allows a provider to request and obtain health information on a patient from other (external) providers. The request comes from a core provider and often arises as a result of unplanned care.
3. In *consumer-mediated exchange*, health information from multiple providers is made available to patients to aggregate and control.

Internal communication and sharing of information is only half the battle, however. The concept of system integration has expanded from the need to connect internally to the need to connect externally across organizations (Markle Foundation 2004). Healthcare organizations need to link to outside institutions or providers 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 Health Information Technology (CCHIT). CCHIT is charged with creating standards of communication for healthcare organizations, and the idea behind such government standards is to force vendors to develop software that meets interoperability requirements. In addition, connectivity must include the organization's business partners and all other providers in an integrated delivery network. For example, exhibit 4.13 presents a schematic diagram of the information requirements for a truly integrated healthcare delivery system (Markle Foundation 2012).

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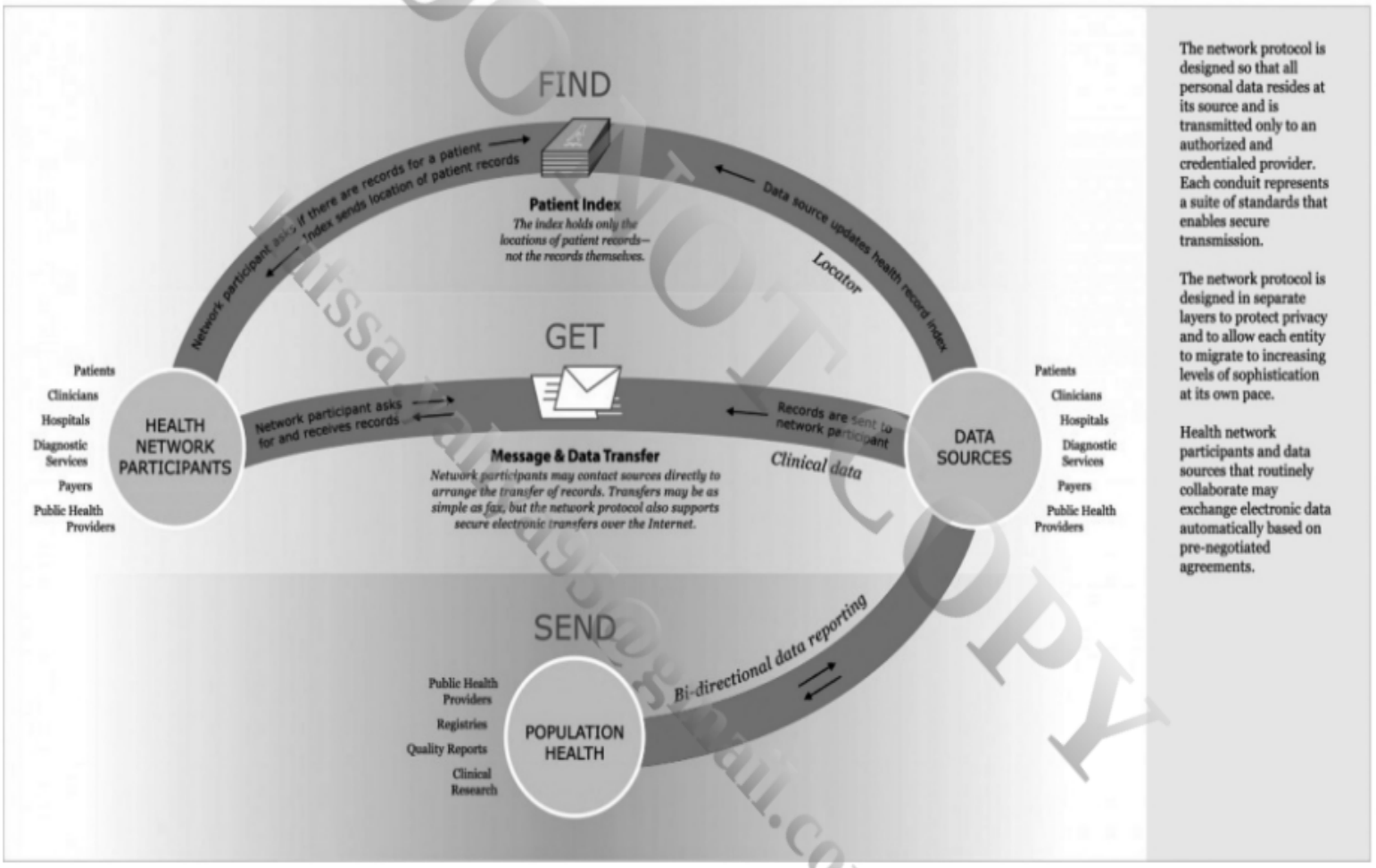
EXHIBIT 4.13

Information Requirements for an Interconnected Network



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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 are essential in today's environment. However, much has yet to be done to achieve this ideal. Former CCHIT chair Mark Leavitt has indicated that two-member entities in the healthcare field have a limited ability to exchange information (Robeznieks 2006), and the final CCHIT chair, Karen Bell, implied that this exchange ability was still limited as of 2012.

Hochman, Garber, and Robinson (2019) argue that information exchange broadly has failed and suggest a more concentrated and mandatory approach is warranted. They contend that a minority of physicians in office practice have the ability to transmit patient information outside of their organization, and only one in three can integrate this external information into their EHR. In its 2018 report to Congress, ONCHIT comments, "As of 2015, 96 percent of non-federal acute care hospitals and 78 percent of office-based physicians adopted certified HIT. As a result, most Americans who receive care now have their health data recorded electronically. However, this information is inaccessible across systems and appropriate end users in the market in ways that can generate value. End users also lack modern tools for accessing information that are common in other industries but are not widely available in health care" (ONCHIT 2018, 8).

Achieving system integration requires careful front-end planning prior to the selection and acquisition of computer hardware and software. The technical aspects of data and software integration are discussed in chapters 8 and 9. The planning processes described in this chapter are essential in ensuring that systems are connected for information sharing across the organization.

The business case for integration stems from the vital impact of comprehensive information on clinical and administrative decision-making. The potential for CPOE to reduce medical errors rests firmly on HIT capacity and integrated medical, nursing, and pharmacy systems (see Hillestad and colleagues [2005] and Johnston and colleagues [2003] for general discussions and findings regarding CPOE, as well as Yu and colleagues [2009] for a comprehensive review). Strategic growth through full use of joint inpatient, ambulatory, and physician practices relies on seamless information flows among and between these entities. Finally, the movement to regional health information networks requires access to and sharing of clinical and financial information among organizations. Investment in the capacity of organizations to share clinical and financial information is occurring in an era of significant cost constraints for healthcare and HIT.

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Summary

HIT governance has expanded in scope and importance along with the growth of the integrative role of HIT. Healthcare organizations that successfully implement HIT must have a governance structure that effectively (1) develops (and consistently applies) a consistent HIT strategic plan; (2) aligns HIT strategy with organizational strategy; (3) develops HIT infrastructure, architecture, and policies; (4) sets and manages HIT project priorities and investments in HIT infrastructure; and (5) documents HIT value or benefits to enhance accountability.

A successful HIT strategic plan includes (1) a statement of corporate or institutional goals and objectives; (2) a statement of HIT goals and objectives; (3) priorities for the applications portfolio; (4) specification of overall HIT architecture and infrastructure; (5) a software development plan; (6) an HIT management and staffing plan; and (7) a statement of resource requirements. The planning process should be guided by an enterprise-wide HIT steering committee, whose membership is composed of representatives from senior management, medical staff, nursing staff, finance, human resources, planning and marketing, facilities, and clinical support services. The CIO should chair the steering committee (if the healthcare organization has established a chair position).

System integration—the ability of information systems to communicate with one another and share information—is essential. Integration can be achieved through a number of alternative network architecture configurations, including a terminal–host system, client and server computing, file and server architecture, peer networks, and grid and cloud computing. In addition, the strategic planning process should include the development of major institutional policies related to HIT. The 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 use of the internet.

An understanding of general systems theory is useful in designing and developing management control systems and in obtaining the kinds of information required to enable such control systems to function effectively. Healthcare systems are open systems, and as such they are influenced by the environment in which they function and exchange information. Key environmental factors include social, economic, political, and physical elements that influence system performance. 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 continuously on current system functioning, monitors to compare these data against predetermined standards, and control elements

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to change inputs or process (or both) when system function is out of control. Management control systems in healthcare organizations can be designed according to the principles of cybernetic systems.

Healthcare delivery viewed in a systems context is information dependent. Effective information for management control purposes has several important characteristics, including dependence on information (not data), relevance and 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 their design and implementation.

Suggested Readings

Wayland, M. S., and W. G. McDonald. 2015. *Strategic Analysis for Healthcare Concepts and Practical Applications.* Chicago: Health Administration Press.

Harris, J. 2017. *Healthcare Strategic Planning*, 4th ed. Chicago: Health Administration Press.

Harrison, J. 2016. *Essentials of Strategic Planning in Healthcare*, 2nd ed. Chicago: Health Administration Press.

Web Resources

A number of organizations (through their websites) provide more information on the topics discussed in this chapter.

The following are consulting organizations with experience and expertise in healthcare information technology:

- Accenture (www.accenture.com/us-en/services/health/health-consulting) provides a wide range of management and healthcare IT solutions.
- CentraForce Health (centraforcehealth.com) provides consulting and management support in information technology.
- CharlesRiver Advisors (www.charlesriveradvisors.com) consults on a wide variety of HIT issues and specializes in helping organizations assess, select, and implement appropriate technologies.
- The Healthcare Innovation Group website (www.hcinnovationgroup.com) contains a vast array of vendors organized by function.
- Klas Consulting (klasresearch.com/best-in-klas-ranking/healthcare-management-consulting/2019/313) consults with IT and other professional in the healthcare space.

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The following are web resources regarding data standards and healthcare data sets:

- The American National Standards Institute's X.12 Group (ANSI; see www.ansi.org) works on specifications for transactions involving the processing of health insurance claims.
- Department of Health and Human Services Office of the Chief Technology Officer (see https://healthdata.gov/content/about) has vast arrays of data sets related to healthcare that are available and accessible to the public.
- The Environmental Protection Agency (EPA; http://enviro.epa.gov) maintains Envirofit, another federal source for data warehousing.

The following provide guidance on governance issues and templates:

- Data Governance Institute (http://www.datagovernance.com) is the principal source of information on data governance for healthcare organizations.
- Erwin: The Data Governance Company: https://erwin.com/blog/healthcare-data-governance
- EHR Intelligence: https://ehrintelligence.com/news/data-governance-best-practices-for-healthcare-health-it
- Varonis, Inc.: www.varonis.com/blog/data-governance-in-healthcare
- KPMG on data governance: https://assets.kpmg/content/dam/kpmg/xx/pdf/2018/06/data-governance-driving-value-in-health.PDF
- HealthIT.gov provides broad overview of governance and planning activities at www.healthit.gov/playbook/pddq-framework/data-governance/governance-management and even tools for evaluating organizational performance at www.healthit.gov/playbook/pddq-framework/worksheet.
- HL7 (www.hl7.org is a standard for healthcare electronic data transmission.

For diverse examples of HIT strategic plans, including guidelines and templates available from associations and vendors, see the following:

- Centers for Disease Control and Prevention strategic plan: www.cdc.gov/od/ocio/docs/CDC-IT-StrategicPlan2017-2021.pdf
- CEB CIO Leadership Council strategy: https://img.en25.com/Web/CEB/CEB_CIO_-_IT_Strategy_on_a_Page.pdf

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- CIO Index strategic planning template: https://cioindex.com/reference/it-strategy-template
- The Joint Commission (www.jointcommission.org) is an accreditation organization that provides guidelines for information management planning and broader strategic planning as a part of its overall accreditation standards (by subscription).
- University of South Florida IT strategic plan 2018–2022: www.usf.edu/it/documents/informationtechnologystrategicplan022018submittedbot.pdf
- Harvard University IT strategic plan: https://huit.harvard.edu/files/huit/files/final_2018_itstrategicplan.pdf
- Indiana University School of Medicine strategic plan 2018–2022: https://medicine.iu.edu/about/strategic-plan

Discussion Questions

1. With the change in the definition of HIT governance, why is the external focus of HIT orientation important?
2. What factors should be considered when developing a consistent HIT strategy?
3. Should the HIT strategy be developed with the HIT department in mind and then aligned with the organizational strategy, or should the HIT strategy be developed with the organizational strategy in mind? Why?
4. Why is data standardization becoming increasingly important in healthcare?
5. Several reasons for central review and approval of software and hardware standards are presented in the chapter. In what other ways could central review and approval assist the organization?
6. What factors and concepts should be included in a master plan for information systems development?
7. What would be the functions of the members of the HIT steering committee, such as senior management, medical, nursing, finance, human resources, facilities, and clinical support services staff? Why is having all these organizational areas represented on the steering committee important?
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 its advantages and disadvantages?

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10. What is the importance of data warehouses or clinical data repositories?
11. Give five examples of simple systems and include the input(s), conversion process, and output(s) in your answer. Ensure that some feedback is included in your examples.
12. Why do closed systems eventually die, while open systems continue to be upgraded and modified?
13. Find examples of the use of cybernetic systems in healthcare, other than the examples provided in the chapter.
14. What challenges does system integration present between and among healthcare organizations? What are the solutions to these problems?

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