Healthcare Information Systems for the Future: The Leadership Challenge
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Abstract

Inspired by the strategic planning efforts of Tripler Army Medical Center, Honolulu, Hawaii, this paper conceptualizes the design of a patient focused information system. Starting with the needs of the organization and senior leadership involvement, the discussion includes: the role of management's philosophy, the mission/vision, and strategic planning. Building on existing work relevant to healthcare organizations, it briefly explores three information system models: Malcolm Baldrige National Quality Award, Joint Commission for the Accreditation of Healthcare Organizations, and the patient focused/delivery of healthcare process model. Finally, the three models are synthesized into a new conceptual model of the ultimate information system and concludes with a leadership challenge.

Introduction

The hospital of the future will be an ever improving patient focused experience. After making an appointment with the central appointment desk, the patient will enter the facility with a bar coded identification card which, when scanned, will automatically in-process the patient into the hospital and set up an account for direct billing to the preprogrammed insurance provider. To prevent fraud, the patient will sign one time on a computer screen to verify the authorized use of the scanned identification card. After scanning in, he or she will be directed to the location where the scheduled appointment will begin. After arriving at the location, the patient will be seen by an appropriate healthcare provider who will call up on the computer terminal monitor the entire patient history both text (physician inputs, test results, etc.) and images (CRT, MRI, X-ray, etc.). After examining both patient and records, the physician will access the expert knowledge data base and review the most recent on-line findings and "text book" diagnostics for the malady at hand. After collecting all the information, the physician then provides a diagnosis.

The healthcare relationship has evolved into a collaborative effort between patient and doctor and so the patient considers the doctor's recommendation along with the on-line patient education data base and then discusses with the physician the plan of attack. The doctor will record the results of the discussion in the computer and the computer will automatically schedule any support services needed by the patient such as physical therapy, pharmaceuticals, surgery, etc. When the patient arrives for surgery their ID card is scanned once more checking them in the hospital along with CRT display directions to the appropriate location. The computer signals the nurse that the patient has checked in and is on the way. The orderly or housekeeping personnel have prepared the pre/post operation room anticipating the patient's preferences such as additional foam pillows which the computer learned last time the patient was in the hospital. No more lengthy bedside interviews, the information system anticipated the patient's needs. At most they may ask for confirmation of the needs listed in their computer via the bedside terminal where the nurse enters the history of stay and orders the services needed during the stay such as medicines, physical therapy, meals, etc.

At the end of the stay the patient rates the services provided by answering an on-line customer satisfaction survey. All follow-up appointments will be automatically scheduled and confirmed prior to departure. When the patient leaves the facility their identification card is scanned again checking them out of the facility. After reviewing a printout of the services provided and the charges, a copy is given to the patient. Upon leaving, the patient simply signs out, automatically authorizing the bill to the insurance provider. The End.

Information Technology (IT) has made significant impacts on the healthcare industry and its ability to provide "quality" care. IT is not new, many organizations have separate high technology information projects and systems designed to serve specific functional areas. What is often missing is an integrated system of information that connects these functional fiefdoms together to facilitate and improve the delivery of service or care. "Because we have not understood that wholes are more than the sum of their parts, we have assembled our information into islands, an archipelago of disconnected data" (Ferguson, 1980, p. 187).

This is not simply a technical problem, it is a leadership challenge. The information technicians have provided most organizations an ocean of data, but few have succeeded in tying it together to provide relevant information to improve management decisions, planning, or quality. Relevant information can only be defined by the user. Developing a connected information system that will facilitate the healthcare experience by providing individuals, teams, upper management, and patients the necessary information to not only provide healthcare but improve performance, requires senior management leadership and vision. "In the past, managers simply delegated technology decisions like this to the in-house computer wizards and attended to other matters. But managers can no longer easily avoid the process of making decisions about information technology. IT affects the entire business from organizational structure to product market strategies. Delegating such important decisions doesn't ensure that IT investments will further the company's business strategy. In fact, it practically guarantees that they won't. The technical experts just don't have a deep enough understanding of where the overall business is going" (Davenport, 1989, p. 130).

The Organization's Needs

As a customer of the information system, the organization's needs should naturally drive the information system design. Beginning with the organization's needs or uses of information, develop requirements or system characteristics such as content, timeliness, access, etc.; design an information system with those characteristics; then identify the input or sources of data required to supply the system. The task of identifying the "big picture" information needs falls on the shoulders of senior leadership. The starting point for these requirements is the management philosophy.

Management Philosophy

Regardless of the information system design, how it is used will determine its success. If the prevailing management philosophy is McGregor's Theory X where management considers all workers to be unmotivated then the information system will help them control and coerce more

efficiently than ever. If management's prevailing philosophy is that of Theory Y where employees are naturally motivated to perform, given the opportunity and knowledge, then the information system can enable and empower the workforce to provide increasing levels of service to the customer or patient. The management philosophy and organizational culture will determine the use of IT. Even naturally motivated people make mistakes. In addition to empowerment, IT can also provide the appropriate controls to ensure "quality of care."

Mission/Vision

The primary drivers of the organization are the customer-focused mission/purpose and vision. "None of the potentially beneficial enabling aspects of IT can take place without clarity of business purpose and a vision of what the organization should become" (Morton, 1991, p. 20). The purpose of the organization is why they are in business and what they provide the customer. A vision is a vivid picture of the ultimate organization. High tech hospitals such as Tripler Army Medical Center (TAMC), Honolulu, Hawaii (rated one of America's 10 Most Computer Advanced Healthcare Facilities by Healthcare Infomatics) has implemented several advanced IT projects such as: telemedicine (providing healthcare to geographically isolated areas); PROMED (wireless Newtons) providing physicians information on their belt, and the Composite Healthcare System (CHCS). Their mission is:

> *"To ensure readiness through the delivery of quality health care."* Their vision is: *"To be the premier health care system in the Pacific Basin."* Working Together We Will: Integrate the best in modern Technology; Seek innovative ways to Adapt to the future; Achieve the best in Medical Education; and Provide responsive, Caring health services, wherever, and whenever needed.

The vision and mission are the compass for the organization and set the direction, but the plan connects them with action!

Strategic Planning

Hugh MacDonald defines strategy as the "mixture of knowledge and assumptions about the organization, goals, objectives, actions, milestones, budgets, and plans, all based on a foundation of knowledge about customers, suppliers, the general environment (political, social, economic, etc.), the actions of competitors, and a number of internal organization factors" (Morton, 1991, p.160). IT both supports and is a product of strategic planning.

IT supports planning by providing leadership with the necessary information to develop a comprehensive strategy. To develop a sound strategy requires an information system that provides the planners with knowledge of the: customer requirements, expectations and satisfaction levels and trends; competitive environment and risks; organization capabilities (technological, people, research, processes, etc.); and supplier capabilities. (Baldrige, 1995, p. 25). IT can also facilitate the process of planning by electronically connecting all the planners throughout the organization from top to bottom. It is vital that the information strategy align with, and support the overall organizational strategy.

In addition to providing input to the planning process, IT should also be a product of strategic planning in the form of IT goals, objectives and action plans. Experts agree, high tech improvements which have increased the quality of healthcare are disconnected. To align their IT endeavors with the organization's overall strategy, Tripler included an IT break out group during their July 1994 two-day strategic planning off-site. This breakout group composed the IT goals and objectives for the organization. These goals serve as principles to guide the IT efforts. "Principles are simple, direct statements of an organization's basic beliefs about how the company wants to use IT over the long term. By translating the main aspects of a company's business strategy into the language of technology managers, these principles bridge the communication gap between top managers and technical experts. This way, business strategy drives technical strategy, as conventional wisdom says it should" (Davenport, 1989, p. 131).
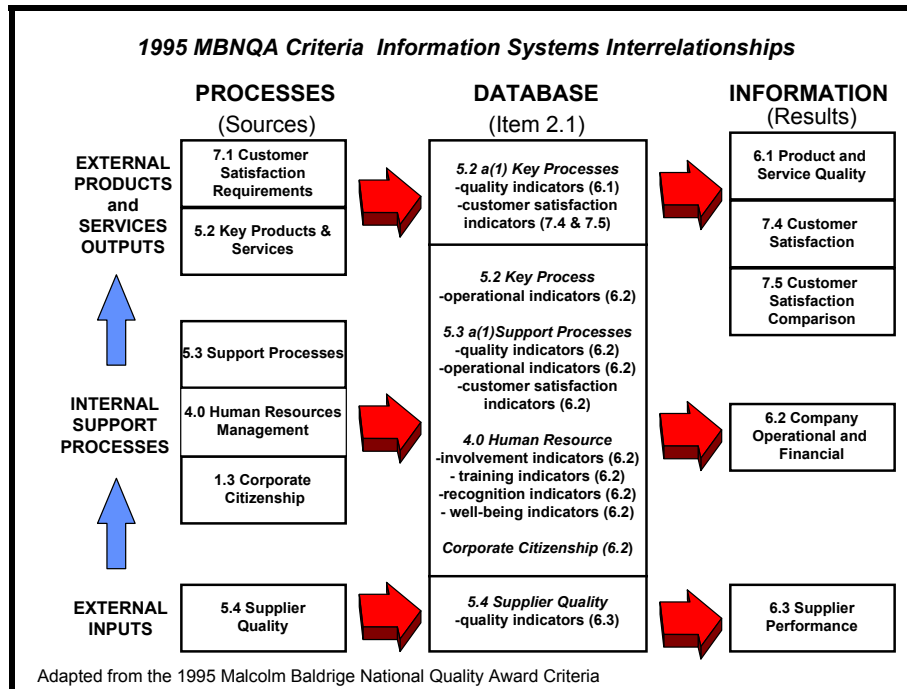
Information System Models

There are numerous conceptual information system models to choose from, all are incomplete in some respect. Two comprehensive information management models are the Malcolm Baldrige National Quality Award and the Joint Commission on Accreditation of Healthcare Organizations. Both models allow the organization the latitude to develop their own custom tailored information system based on the organization's unique needs.

Malcolm Baldrige

Although "non-prescriptive" in nature the Baldrige criteria asks the key questions to consider when conceptualizing an information system. The criteria address information in two ways. First, Category 2.0 of the criteria asks what type of data the organization collects and how it compares, analyzes, and uses the data to create information to support management and improvement efforts. Second, the criteria ask for actual organizational results, both levels and trends, for many of the systematic approaches and their deployment described throughout the assessment report including customer satisfaction.

The organizational activities that determine the data base can be sub-divided into three major process components: the output, the internal processes, and the input. The output is the customer required key products and services provided by the organization. The internal processes are the organization's internal activities that enable the key products and services, and the inputs are the external supplies required by the organization.
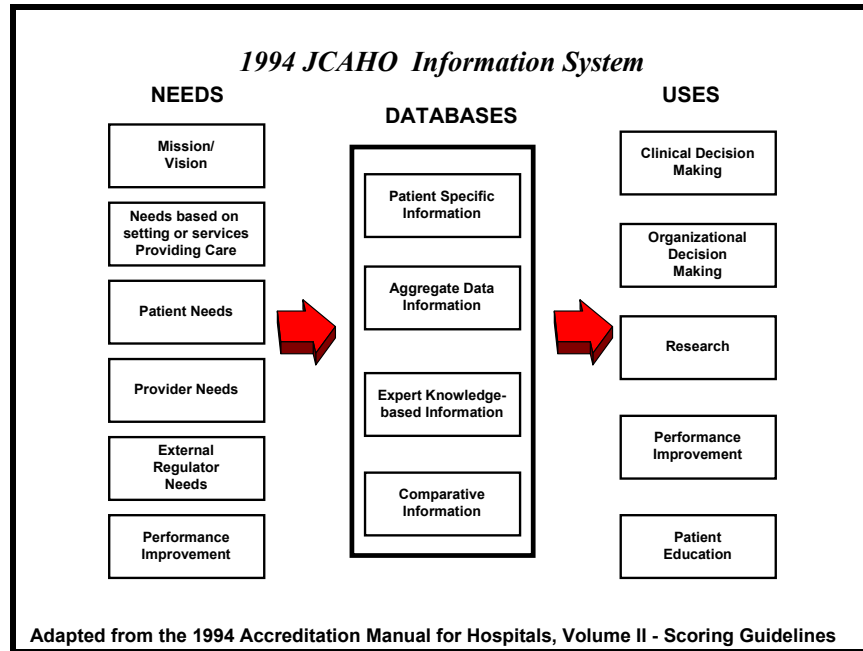
(figure 1)

Joint Commission for the Accreditation of Healthcare Organizations (JCAHO)

The JCAHO criteria also provide a model of an information system geared toward the specific needs of a healthcare organization. Driven by the mission and vision, the JCAHO model starts with a needs assessment. This needs assessment consists of the needs of: the patient, provider, regulator; performance improvement and needs based on setting or services providing healthcare. These needs are met by four sources of information: patient specific information, aggregate data information, expert knowledge based information, and comparative information. The primary uses of these data in the model are: clinical decision making, organizational decision making, research, performance improvement and patient education. "The organization assesses its needs for information management based on its mission, goals, services, personnel, mode(s) of service delivery (for example, hospital, home care, ambulatory), resources, and access to affordable technology" (JCAHO, 1994, Section 2 p. 5).

Although both the Baldrige and JCAHO models are customer focused they do not emphasize the customer's experience. Often in the service industry the consumption and delivery of the service occur simultaneously. This is certainly the case in healthcare. While we can define the needs of the patient in both the Baldrige and JCAHO models they do not emphasize the importance of the "healthcare experience." Improving quality of healthcare requires a patient's perspective. While many organizations develop extremely effective information systems for the various functions, few have effectively tied them together to improve the quality of care as seen and defined by the customer, the patient. The patient doesn't see the various functions within a hospital as separate entities. The patient experiences the healthcare process.

(figure 2)

Customer Focused (Process vs. Function)

To be effective in improving quality as seen by the patient the information system must be designed to enhance the "process" of providing healthcare (figure 3). The patient experiences a typical hospital starting with the administration department by scheduling an appointment and ends when the patient no longer needs aftercare. Regardless of how good the actual surgery goes, the patient remembers waiting an hour on the surly x-ray technician who couldn't read the illegible x-ray request. "We have found that successful 'between-function' integration collapses the multistage value-added chain into three major segments: producing new products, delivering products to customers, and managing customer relationships" (Morton, 1991, p. 207).
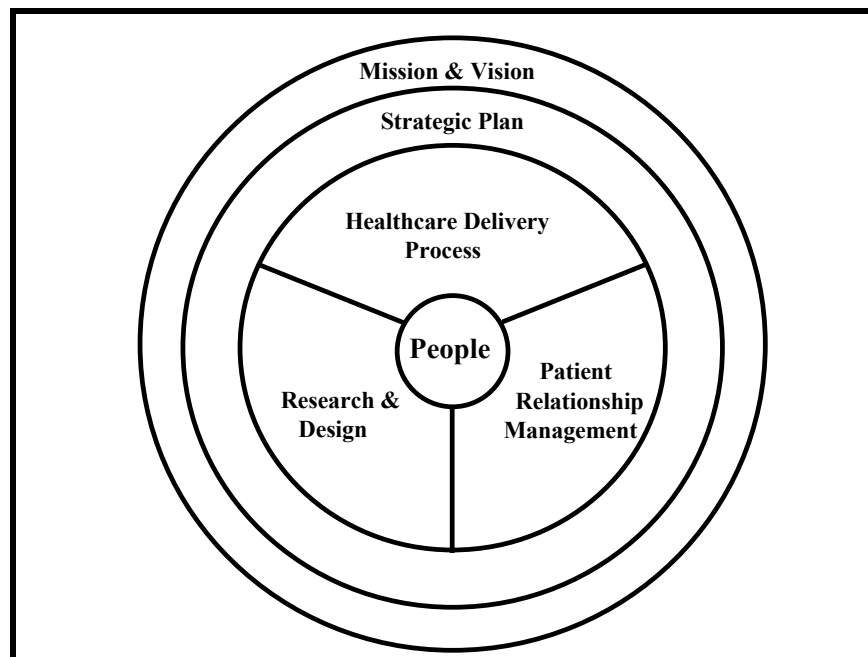

(figure 3)

John Latham, 1995
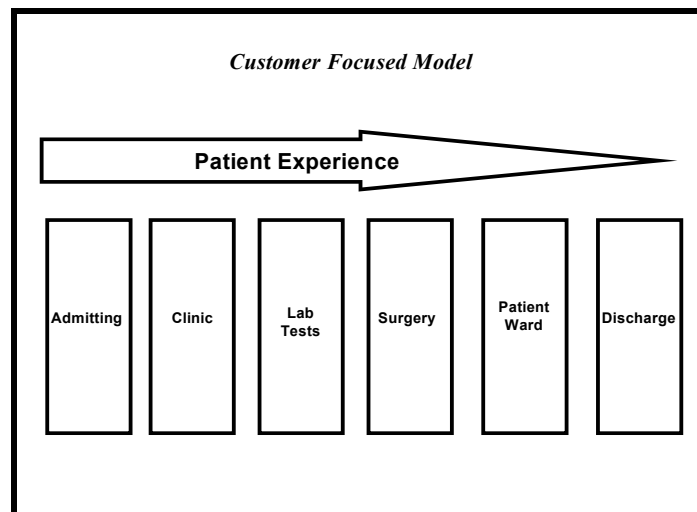
Synthesis

Creating an information system which represents the best of all three models (Baldrige, JCAHO, and Customer Focused) provides the organization a system which will help the healthcare facility improve the overall organizational performance using Baldrige self-assessments; meet accreditation requirements of JCAHO; and ultimately serve the patient better, reduce the risk of litigation, increase satisfaction, market share and in turn profitability. This new model is completely surrounded by the Mission and Vision which are connected to the organization by the Strategic Plan. The core of the system includes Patient Relationship Management; Healthcare Delivery Process; Research and Design with a nucleus of people.

Mission and Vision

The mission and vision provide the foundation and direction for the entire organization. A complete vision includes the "vision trilogy" of the ultimate product/service, people, and culture. "There are at least two ways in which leaders communicate their interests to an organization. First, by the way they spend their time and, second, through their direct communications with employees" (Boone, 1991, p. 207). IT such as e-mail provides the senior leaders the ability to effectively and continuously articulate the organization's vision, mission, patient focus, and strategy. Improving the organization does not happen by accident, it is the result of a purposeful plan.

(figure 4)

Strategic Plan

The strategic plan connects the mission and vision with the *real* organization. To create goals and objectives which provide the connection, the strategic planning process requires information input to enable senior leaders to analyze the organization's capabilities and environment. IT also facilitates the development, communication, implementation, and feedback of subordinate plans throughout the organization. And finally, the strategic plan includes goals and guiding principles for IT itself. The three major segments of any organization are design, delivery, and customer relationship (Morton, 1991, p. 207). These three segments form the core of the healthcare information model.

Patient Relationship Management

As the focus of the hospital, the patient's needs drive the organization and its processes. Patient relationship management requires information for three basic functions: determine patient requirements; assess patient satisfaction; and provide patient education.

There are two types of patient requirements: generic and specific. The generic requirements are the needs, wants and desires common to most patients. Fortunately for the hospital the patients are a captive audience. The hospital can simply ask the patients how they define quality care. Some facilities use patient focus groups to determine common patient needs, wants, and desires. Regardless of the methods of collecting customer requirements, this information must get to the appropriate individuals to use in designing, executing, and improving the processes. The second type of requirement is the specific requirements peculiar to the individual patient. These could be special conditions or impairments that the hospital needs to know about in order to provide the proper care.

After the hospital designs in healthcare service characteristics to meet the patient requirements and performs the service it is time to validate the process. "In short, assessing process quality is assessing how well the ultimate product or service delivered to the customer meets the customer's needs, measured in the customer's terms" (Morton, 1991, p. 198). There are two ways in which to measure patient satisfaction: perception and behavior. To measure the patients' perception of quality simply ask the patient how happy they were with the experience. Although perceptions are informative, behavior is the key. The bottom-line is do they come back? The trend in our society toward self-determination includes the healthcare process. Most of us no longer blindly follow our doctor's orders. Instead we view healthcare decisions to be a collaborative process between ourselves and the physician.

> Alvin Toffler called it "the punctured power of the god-in-a-white-coat. Throughout the heyday of doctor-dominance in America, physicians kept a tight choke-hold on medical knowledge. Prescriptions were written in Latin, providing the profession with a semi-secret code, as it were, which kept most patients in ignorance. Medical journals and texts were restricted to professional readers. Medical conferences were closed to the laity. Doctors controlled medical-school curricula and enrollments. Contrast this with the situation today, when patients have astonishing access to medical knowledge. With a personal computer and a modem, anyone from home can access data bases like Index Medicus, and obtain scientific papers on everything from Addison's disease to zygomycosis, and, in fact, collect more information about a specific ailment or treatment than the ordinary doctor has time to read" (Toffler, 1990, p. 8).

This type of information support improves the quality of healthcare by increasing the participation of the patient in the service delivery and outcome.

Healthcare Delivery Process

The healthcare delivery process is different for each patient, each time they visit. With this kind of variation in requirements, how can the organization improve the process? IT can help the organization customize the process with unbelievable speed and accuracy. If the functional silos are connected and communicating then they can work as a team to anticipate the patient's arrival and needs at each step along the value-added chain of activities.

IT can enable the organization to control its processes to ensure critical requirements are met. Accurate and timely patient records are important to proper care. Pharmacy controls must ensure the patient receives the proper medicines. IT can help ensure the accuracy of results data from tests and limit the access to those with the need.

IT can enable the physician and the patient to make sound decisions based on all the relevant information. IT can provide the physician an entire patient medical history, both text and images, and on-line diagnostic help based on the latest medical knowledge. Medicine is progressing at a rapid pace. It is impossible for physicians to keep current on every little detail. IT can provide this information as needed but the clinical decisions and the operational controls are only as good as the inputs.

IT contributes to supplier quality improvement in two ways. First, IT can collect, analyze and display the supplier quality results providing an essential input to the planning process. Second, IT can facilitate the communications between the hospital and its suppliers. One example would be using bar coding; the information systems of organizations can continuously communicate inventory levels and automatically execute orders when the inventory drops to a predetermined level.

The competitive marketplace and insatiable customer desires, demand continuous improvement. Improving both individual and process performance requires knowledge of both the requirements and the current performance.

Comparisons and benchmarks help in understanding the significance of the results. A comparison provides a reference to better understand your current performance level. Benchmarks provide a valuable reference to study and adapt to the organization's processes. The information system should automatically collect and incorporate this information on the performance charts. Another method to improve the process is research and design.

Research

Designing and redesigning services requires information to build in the customer, process, supplier, and human resource requirements. Research is not limited to new surgical techniques

and cures for disease. Research also includes designing new services such as telemedicine or a bar coded pharmacy. Industrial research or benchmarking is also a very useful advanced tool to improve the organization's processes. Improving the organization's processes is crucial ; however, the organization still requires well trained, involved, motivated, healthy workers to make it run.

Human Resource Development Effectiveness

People are the nucleus of any organization. The hospital is a very knowledge intensive environment requiring highly trained people. Consequently, the people development programs are crucial to a quality healthcare process. Measurement of the systematic approaches to involve, train/educate, motivate, and provide for employee health and well-being is essential to validate and improve their performance.

How effective are the employee involvement programs such as suggestion systems, process action or improvement teams, natural working groups, etc.? How many people are involved and what are their results? The goal is to continually improve the involvement mechanisms to fully engage everyone in improving the organization.

What gets measured gets done, what gets rewarded gets repeated. How effective is your recognition and compensation system at encouraging and promoting the role model behavior aligned with and supporting the strategic plans goals and objectives?

How effective and extensive are your training and education programs for professional, managerial, and quality improvement skills? Does this training support the goals and objectives in the strategic plan?

Are the employees happy and healthy? Overwhelming research shows a strong positive correlation between customer satisfaction and employee satisfaction. Simply put, happy care givers make happy patients!

Conclusion

The typical approach to designing a complex system is to break it down into small components, design the individual components, then put them together again to work as a system. The problem with this approach is very often the optimized individual components don't work very well together. The leadership challenge is to conceptualize a connected system to accomplish the organization's purpose and make the organization's vision a reality. It is a leadership responsibility too important to be left to the technicians!

Planning Questions for Senior Leaders:

1. What is our management philosophy (control, empower, or both)?
2. What is the organization's mission or purpose?
3. What is our vision?
4. How are we going to achieve this vision (what are our goals and objectives)?

5. What information is needed to make these objectives, goals, and vision a reality?
6. Who needs what information when?
7. What does the information *system* look like that gets the right information, to the right people, at the right time?

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