Organizational innovation and the laboratory information system

Empowering your staff will turn them into stakeholders.

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There is an urgent need for more innovation in health care and in clinical laboratories. Innovation can be divided into five separate categories: core products, components of the core products, production processes, uses of products, and the organization of production. Organizational innovation is as important as technological advances in increasing the quality and efficiency of clinical laboratories. The use of a laboratory information system (LIS) can stimulate organizational innovation such as the assignment of computer-oriented tasks to personnel within individual clinical laboratories. The authors refer to such LIS support personnel as “hidden personnel” and suggest that such a shift of responsibility empowers laboratory professionals and makes them stakeholders in automated information processing.

Introduction

It has become increasingly obvious during the past decade that there is an urgent need to foster a more innovative spirit in many U.S. organizations in order for them to remain competitive in local and world markets. The health-care industry is no exception. If anything, there may be a greater need for innovation because of the intense pressure by third-party payors and hospital accreditation organizations for simultaneous increases in the quality of health-care services and decreases in their cost. This article discusses innovation in clinical laboratories, emphasizing organizational innovation in hospital-based clinical laboratories.

What is the core product of clinical laboratories?

During the past decade, hospital-based clinical laboratories have undergone major changes in the core products they offer to their clients and the way that these core products are produced, distributed, and
used. The core product of clinical laboratories consists of test results and the value added to them by the laboratory information system (LIS). Taylor helped to popularize the concept that information systems add value through the use of information storage, sorting, and distribution (1).

The concept that information (such as a test result) is a product can be elusive, particularly when such information is distributed electronically—not in a hard copy format. We believe that the health-care system can be viewed as a producer of information, in addition to the more traditional view of it as a service industry. In fact, laboratory personnel may be more receptive than nurses or physicians to the notion that test results, as well as other information generated during the care of a patient, are products.

What is innovation?  

Innovation can be defined in many ways, including "putting a new product, service, or problem-solving idea into use" (2,3). Regardless of how it is defined, the essence of innovation is injecting fresh ways of doing business into an organization. Innovation is highly desirable when it promotes efficiency and effectiveness and when it allows organizations to adapt to a rapidly changing environment. Of course, not all innovations are highly desirable. Many innovative ideas and products are destined to fail for myriad reasons.

According to Schumpeter, innovation can be introduced in five distinct areas of an organization:

1. core products
2. components of the core products
3. production processes
4. uses of products
5. the organization of production (4).

Because a change in one category is likely to produce changes in the others, one measure of the impact of a change is the number and type of changes it spawns in the other categories.

In the clinical laboratory setting, changes and their consequences in the first four categories are quite obvious. For example, a clinical laboratory frequently will offer a new test, or a modification of an existing test, to hospital clinicians. This practice, driven both by user demand and the emergence of new technology, constitutes an innovation of the core product of the laboratory. Implementing a new or modified test frequently requires new test system components such as a new reagent (i.e., innovation in components) or a new analytical instrument (i.e., innovation in production processes). In turn, the new or modified test creates opportunities for clinicians to diagnose or monitor the status of a disease in a patient (i.e., innovation in the uses of the information product).

What is organizational innovation?  

Organizational innovation, the fifth Schumpeterian category, involves changes in how people interact while working to produce a product. Organizational innovation may be the most difficult of the four categories to recognize in the clinical laboratory milieu for two reasons. First, innovation, in the minds of many laboratory workers, is intimately linked with hard science or technology, whereas how work is organized is commonly perceived as "low-tech."

Installing an automated test instrument or a LIS would be easily recognized by laboratory workers as innovative, whereas changing the order in which specimens are collected by phlebotomists in patient care units would not. This is unfortunate because the way in

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which work and people in clinical laboratories are organized, as in all other complex organizations, profoundly influences the efficiency and quality of the organization.

Organizational innovation also may be difficult to recognize within clinical laboratories because their formal organizational structures have been relatively stable for several decades. Clinical laboratories are commonly organized into discipline-oriented organizational units such as clinical chemistry, hematology, blood bank, histopathology, and microbiology. A medical technologist, the chief technologist, or an individual with an advanced degree such as a Ph.D. is usually appointed as the technical leader and manager. A pathologist is usually appointed as the medical director. In larger hospitals, there may be a pathologist/director of both clinical pathology and anatomic pathology. For departments of pathology, the chief technologist or technical director of each laboratory may also report to a laboratory-wide business manager regarding personnel and financial matters.

Organizational
innovations in clinical laboratories

Whether or not it is recognized, organizational innovations have been continually occurring within clinical laboratories. Table 1 lists many important organizational changes that have occurred during the last decade.

The pressure for many of these changes has come from forces outside clinical laboratories— including third-party payors, accreditation agencies, and health-care consumers. The presence of such external stimuli is not unusual. In any service or industrial sector, many changes are the result of external demands for problem-solving, rather than internally generated solutions to perceived problems (5). On the other hand, some of the changes have been internally generated and represent the pursuit of more streamlined and efficient laboratory operations.

Organizational innovation and the LIS

In creating Table 1, we intentionally omitted organizational innovations related to the LIS—one of the most important technological achievements of the last decade. The deployment of the LIS in a hospital represents innovation in the production process, analogous to the implementation of a new analytic instrument for test production. Prior to the implementation of the LIS, individual laboratories published test results on “shingle sheets” that were distributed to patient care units and then posted in the medical records of patients. In contrast, the LIS receives test results from various laboratories, organizes them in reverse chronological order and by laboratory, and generates interim and final hard copy reports.

The LIS adds new components to the existing core information product of laboratories, thereby changing the core product itself. The simplest example is the LIS-mediated modification of the reference range of a test result on the basis of the age and sex of the patient. More sophisticated examples include electronic reporting of test results to a physician’s private office and sophisticated searching and retrieval options in the laboratory data base. The more rapid turnaround time for test results can reduce duplicate test ordering by clinicians and the length of the test-ordering cycle, potentially reducing lengths of stay for patients undergoing diagnostic hospital workups.

The LIS also provides opportunities for clinicians to acquire new information and to change their use of the information product of the laboratories. Examples include:

1. electronic mail links between clinicians and pathologists that facilitate communication and consultation about interpretation and utilization
2. reflexive testing, whereby additional tests beyond those initially ordered by the clinician are automatically performed if positive results are obtained from the first set
3. decision-support software that scans test results and provides diagnostic assistance to clinicians.

However, unlike other major innovations such as the installation of automated test instruments, the influence of the LIS goes far beyond component, core product, production, and usage innovation. The LIS produces organizational innovations because of its role as a critical horizontal and vertical integrator of the laboratory. It is a critical back-end and front-end for all laboratory operations. As a result of using the LIS, laboratories become a homogeneous system rather than a loose confederation of individual operations. The changes are similar to those that occurred in radiology departments when CT scanners were introduced during the 1970s: the complex technology redistributed power to those who understood and controlled it and threatened those who did not understand it (6).

Table 2 lists some of the major
organizational influences of the LIS on clinical laboratories. Space does not permit a detailed discussion of all these items. Rather, we shall concentrate on the gradual shift of workload and political power from individual clinical laboratories to the LIS unit and the way in which laboratories can accommodate this shift.

## Evolution and staffing of the LIS

The typical first reaction to the LIS is to treat it like another laboratory, such as the chemical pathology or hematology laboratories, and to establish it as a separate organizational unit within pathology with the mission of supporting computer operations. A medical technologist with supplemental training is often appointed the manager of the unit, and a pathologist may be assigned as the medical director. Such a course of action, however, will only be temporary because information processing cannot be neatly compartmentalized. LIS activities greatly affect all laboratories and transcend the traditional organizational model of clinical laboratories.

As a general rule, only a small number of personnel are initially assigned to LIS units because of the perception that the LIS is a "turnkey" operation and because there is always extreme competition for personnel in hospitals. Therefore, the importance of the LIS is not initially reflected in the number of individuals assigned to it. This is an example of innovation in production processes outstripping the speed of organizational change.

Nonetheless, the political power of LIS personnel within pathology is increasing rapidly because of the importance of computer operations to the well-being of laboratories and because of the role of the LIS as the prime horizontal and vertical integrator. Power is difficult to define but usually not difficult to recognize: those who possess power are able to bring about the outcomes they desire (7). For instance, technologists within the individual laboratories find themselves conferring frequently with LIS personnel about the issues of:

- changes in methods when a new test is introduced
- interface issues and test report formatting before the purchase of a new laboratory instrument
- laboratory staffing during and after scheduled LIS "down" times.

We wish to emphasize that the need for consultation with LIS personnel flows out of the role of the LIS as a horizontal integrator of laboratories and not necessarily from a quest for political power. On the other hand, political power does accrue to those organizational subunits that can best solve the strategic problems of an organization (8). Many of the major strategic problems facing clinical laboratories in the future—the automation of quality assurance, the development of recurrent and ad hoc management reports, and reduction of test turnaround time—are highly dependent on newer LIS applications.

## Growing concern about the influence of LIS personnel

Laboratory personnel are concerned about this shift in power and control, with LIS personnel as the primary beneficiaries of the change. Their sense of concern stems from the following perceptions:

1. a loss of ownership of the laboratory data base
2. a loss of authority and responsibility for what were previously laboratory-specific tasks

### Table 2
Examples of organizational influences of the LIS on the hospital-based clinical laboratories and the hospital itself

- Gradual shift of workload and political power from individual laboratories to the LIS unit
- Growing influence of LIS personnel as strategic planners because of their comprehensive knowledge of all laboratory operations
- Competition for LIS positions among ambitious medical technologists because of upward career mobility
- Competition by the LIS, as a big-ticket item, with other pathology capital equipment expenditures
- Unwanted interest from hospital administrators about the LIS—a high-visibility, expensive, and mission-critical system
- Tendency for success or failure of the LIS to shape general opinions about the laboratories among clinicians and nurses
a sense of professional inadequacy as performance criteria are modified to include computer expertise.

In essence, many staff members in the laboratories believe they have been co-opted by the LIS and would like to regain their previous organizational influence and control over the laboratory data base.

These negative feelings are an undesirable consequence of the LIS. Steps should be taken to “empower the stakeholders” in laboratory operations; that is, to ensure that laboratory professionals regard themselves as “owners” of the laboratory information data base. Because the LIS is unlikely to disappear, the best way to empower laboratory professionals is to increase their opportunities for high-level LIS interactions. The specific question, then, is how to foster such interactions.

Hidden personnel in the LIS unit

Interestingly enough, the process of creating a widespread sense of ownership of the clinical laboratory data base has already begun, but in a fashion that may not be obvious to the casual observer. There are two groups of LIS support personnel within clinical laboratories. The first group is the personnel formally assigned to the LIS unit. The second group is the individuals who are assigned to one of the various clinical laboratories but who actually spend a considerable fraction of their work day solving computer-related problems for the laboratory in which they work. We refer to them as “hidden personnel” in the LIS unit.

These hidden personnel have become empowered with regard to the LIS and the laboratory data base and can be referred to as the first contingent in the migration of personnel from the clinical laboratories to the LIS. This shift makes sense because as functions migrate to the LIS, positions—or fractions of positions—should be transferred as well. Moreover, the informal shift serves the best interests of laboratories by the training of “bridging” personnel who understand both the information flow of the laboratory and computer technology. It can usually be accomplished without provoking the political infighting that would accompany a request for the formal transfer of personnel.

Two generalizations apply to the hidden LIS personnel embedded in individual clinical laboratories. First, individuals under consideration often are self-selected and therefore highly motivated. If the chief technologist in a clinical laboratory elects not to act as the key liaison for LIS operations, the responsibility is delegated to a subordinate with demonstrated ability and interest in the area. Many medical technologists gladly volunteer for such a position because they view pathology informatics as a growing field and an opportunity to acquire new skills and to achieve upward career mobility. Because of the high motivation, the individuals become product champions (9) and increase the chance that LIS innovations will be successful.

The second generalization is that the hidden personnel rarely feel disaffected with regard to LIS activities because they view themselves as part of the computer milieu. In other words, they have become empowered. The cynic, observing this same process, might describe them as co-opted. In either case, the fact that these hidden personnel have positive attitudes toward the LIS suggests that empowering more personnel in the various laboratories will reduce the tension between the LIS and the individual laboratories.

The emergence of these hidden personnel constitutes a spontaneous and effective organizational response to the LIS integration problem and should be encouraged. The value of these individuals transcends morale and data base ownership issues. They also comprise a group of bridging professionals, well versed in both computer issues and in the details of their own laboratory discipline. As such, they are part of an organizational innovation introduced by the LIS.

REFERENCES