

The Adoption and Implementation of Knowledge Management in Healthcare Operations

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ABSTRACT

The importance of knowledge management (KM) to organizations in today's competitive environment is being recognized as paramount and significant. This is particularly evident for health care in this country. The US healthcare system is facing numerous challenges in trying to deliver cost effective, high quality treatments and is turning to KM techniques and technologies for solutions in an attempt to achieve this goal. What is becoming of particular interest is the adoption and implementation of KM and associated KM technologies in the healthcare setting, an arena that has to date been notoriously slow to adopt technologies and new approaches for the practice management side. We examine this issue by studying the barriers encountered in the adoption and implementation of specific KM technologies in healthcare settings. With some empirical data we then develop a model that attempts to draw some conclusions and implications for orthopaedics.

Keywords: healthcare, knowledge management, adoption, implementation, orthopaedics

1.0 INTRODUCTION

The industrial economy has given way to the electronic economy creating an entirely new set of rules, opportunities, threats, and challenges (Accenture). The growth of electronic commerce (e-commerce) is vast, complex, and rapidly expanding. The evolution of the 'Information Age' in medicine is mirrored in the exponential growth of medical web pages, increasing number of online databases, and expanding services and publications available on the Internet. In order to make sense of the mass of data and information that is now being generated, organizations are turning to knowledge management techniques and technologies.

The healthcare sector is no exception to this. What we believe is not only interesting but also critical to understand is the adoption and implementation of knowledge management techniques and technologies in the healthcare sector—an industry that has to date been very slow to embrace new information technologies to benefit the administrative, as opposed to the clinical, aspect of medical practice (Battista and Hodge, 1999). To date, little has been written about knowledge management (KM) in health care, and even less on the phenomenon of the adoption and implementation of KM technologies and systems (Shakeshaft and Frankish, 2003).

In this paper we address the void in the literature by presenting some results from a study of KM adoption in a select healthcare setting. This is a case of KM in orthopedics practice in the United States. We analyze this case with a model that identifies the barriers to the process of adoption and implementation of KM in healthcare organizations. We believe that this type of research may lead to a better understanding of what it is about KM that is so crucial for health care today, and the better processes and mechanisms that would help in its implementation (Eger et al., 2003).

2.0 THE HEALTHCARE INDUSTRY

Health care is not only a growing industry but it is also the biggest service business on the globe. Between 1960-1997 the percentage of Gross Domestic Product (GDP) spent on health care by 29 members of the Organizations for Economic

Cooperation and Development (OECD) nearly doubled from 3.9 to 7.6% with the US spending the most—13.6% in 1997 (OECD Health Data 98). Hence, healthcare expenditures are increasing exponentially and reducing them; i.e., offering effective and efficient quality healthcare treatment, is becoming a priority globally. Technology and automation have the potential to help reduce these costs (Institute of Medicine, 2001; Wickramasinghe, 2000).

In their continuing effort to increase the role of technology in their operations, healthcare providers are employing many opportunities to incorporate IT and telecommunications with e-commerce strategies to improve service and cost effectiveness to its key stakeholders. Many such e-initiatives, including the e-medical record, are currently being implemented in various countries; however, these alone have been found to be insufficient in achieving the desired performance and economic goals without also incorporating KM techniques and technologies into clinical and administrative practices (Wickramasinghe and Mills, 2001).

2.1 Key Factors Influencing the US Healthcare Sector

In the US, two key factors are leading the various stakeholders throughout the healthcare industry to adopt various new technologies and their aims are to enable these organizations to practice better management. These factors are: (i) managed care and (ii) the Health Insurance Portability and Accountability Act (HIPAA, Public Law 104-191).

Managed care was introduced over a decade ago as an attempt to stem the escalating costs of health care in the US. It is aimed at creating value through competition, with the intended result of providing adequate quality health care and yet to minimize, or at least to hold, the line on costs (Wickramasinghe & Silvers, 2003). The principal participants involved in any managed care arrangement include the following five categories of stakeholders: the Managed Care Organization (MCO), the purchaser, the member, the healthcare professional, and, if applicable, an administrative organization (Knight, 1998).

The Health Insurance Portability and Accountability Act was signed by President Clinton on 21 August 1996. This Act is definitely providing a strong impetus for the US healthcare sector to embrace various e-technologies because it aims to improve the productivity of the American healthcare system by encouraging the development of information systems based on the exchange of standard management and financial data and by using EDI (Electronic Data Interchange). In addition, the Act also requires organizations exchanging transactions for healthcare to follow national implementation guidelines for EDI established for this purpose. This poses many significant challenges to healthcare institutions. A key challenge is the need to make significant investments in technology to facilitate and enable these functions to take place and to also develop the appropriate standards and protocols required. In 2005-2006 the Bush Administration has also announced several initiatives to encourage the use of information technology in healthcare delivery.

2.2 The Future for Healthcare

Health care has been shaped by each nation's own set of cultures, traditions, payment mechanisms, and patient expectations. Given the common problem facing health care globally, i.e., exponentially increasing costs, no matter which particular health system one examines, the future of the healthcare industry will

be shaped by commonalities based on this key unifying problem and the common solution; namely, the embracing of new technologies to stem escalating costs and improve quality healthcare delivery.

Currently, the key future trends that will perhaps significantly impact health care include: (i) empowered consumers, (ii) e-health adaptability; and (iii) a shift to focus on healthcare prevention. Key implications of these future trends include (i) health insurance changes, (ii) workforce changes as well as changes in the roles of stakeholders within the health system, (iii) organizational changes and standardization, and (iv) the need for healthcare delivery organizations and administrators to make difficult choices regarding practice management (Wickramasinghe, 2000). In order to be well positioned to meet and manage these challenges within the US and elsewhere in the world, healthcare organizations are turning to KM techniques and technologies. Thus, as the role of KM in health care increases in importance, it becomes crucial to understand the process of adoption and implementation of KM systems.

3.0 THE NATURE OF KNOWLEDGE MANAGEMENT

Knowledge is a critical resource in any organization and is also crucial in the provision of health care. Access to the latest medical research knowledge is often the difference between life and death, between accurate or erroneous diagnosis, and between early intervention or a prolonged and costly hospital stay. Knowledge management deals with the process of creating value from an organization's intangible assets (Wickramasinghe and Mills, 2001; Edwards et al., 2005). It is an amalgamation of concepts borrowed from the artificial intelligence/knowledge based systems, software engineering, BPR (business process re-engineering), human resources management, and organizational behavior (Purvis et al. 2001). Knowledge management deals with conceptualization, review, consolidation, and action phases of creating, securing, storing, combing, coordinating, and retrieving knowledge. In essence, then, knowledge management is a process by which organizations collect, preserve, and utilize what their employees and members know about their jobs and about activities and procedures in their organization (Xu and Quaddus, 2005).

3.1 The Need for Knowledge Management

Sustainable competitive advantage is dependent on building and exploiting core competencies. In order to sustain competitive advantage, resources which are idiosyncratic (thus scarce) and difficult to transfer or replicate are required. A knowledge-based view of the firm identifies knowledge as the organizational asset that enables sustainable competitive advantage especially in hyper competitive environments or in environments experiencing radical discontinuous change.

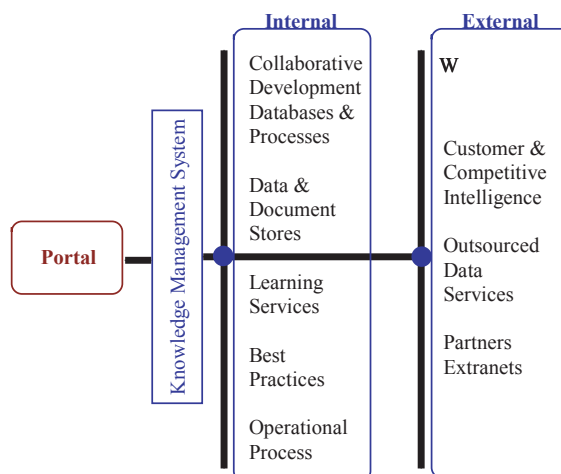
Thus, it makes sense that the organization that knows more about its customers, products, technologies, markets, and their linkages should perform better (Gafni and Birch, 1993). Many organizations are drowning in information overload yet starving for knowledge. Knowledge management is believed to be the current savior of organizations, but its successful use entails much more than developing Lotus Notes' lessons learnt databases. Rather it involves the thoughtful design of various technologies to support the knowledge architecture of a specific organization (Wickramasinghe and Mills, 2001).

3.2 The Value of Knowledge Management To Healthcare Organizations

Knowledge management is a still relatively new phenomenon and a somewhat nebulous topic that needs to be explored. However, organizations in all industries, both large and small, are racing to integrate this new management tool into their infrastructure. Knowledge management caters to the critical issues of organizational adaptation, survival, and competence in the face of increasingly discontinuous environmental change (Rubenstein and Geisler 2003). Essentially, it embodies organizational processes that seek synergistic combination of data and information processing capacity of information technologies, and the creative and innovative capacity of human beings.

Knowledge management realizes the importance of safeguarding and using the collective knowledge and information of an organization. Through surveys, interviews, and analysis, knowledge management seeks to excavate, measure, assess, and evaluate the knowledge and information held within an organization with the intention of making the organization more efficient and profitable. Essentially, knowledge management sifts through the collective knowledge of an organization, codifies it into an information base, and then spreads it throughout

Figure 1. Aspects of a generic knowledge management system and their importance in the organization



the organization so it can be easily accessed (Wickramasinghe and Mills, 2001; Geisler, 2006).

The knowledge management system is extremely helpful in internal and external sectors of an organization. Internally, knowledge management is designed to enhance the maintenance and organization of the data bases. Externally, it aims to make a better impact on the customer and external partners. Figure 1 depicts the importance of knowledge management in an organization.

3.3 The Role of Knowledge Management in Healthcare Organizations

The healthcare sector is characterized by its diversity and the distributiveness of its component organizations. There is a continuous process of generation of knowledge within each of these components (such as providers, patients, suppliers, payers, and regulators), as well as an immense volume of knowledge created at the interfaces among these organizations (Jadad et al., 2000; Pavia, 2001).

Healthcare provider organizations are special type of organizations in that they are for the most part motivated by topics such as quality and service, but without the profit drivers that animate private industry. At the same time they are highly professional institutions, populated by people with specialized knowledge that needs to be constantly updated, shared, and leveraged (van Beveren, 2003). This phenomenon creates even more pressure on healthcare providers and others in the sector to manage the knowledge that flows through the sector.

Although there has been little empirical investigation of how knowledge management benefits healthcare organizations, it is safe to assume that its contributions would be at least as positive as they are being shown in other sectors of the economy (Eid, 2005).

The role of knowledge management in healthcare organizations would be important in both clinical and administrative practices. Clinical care would be much more effective with increased sharing of medical knowledge and "evidence-based" experience within and among healthcare delivery organizations (Nykanen and Karimaa, 2006).

Administrative practices in healthcare organizations will benefit from the systemic interfaces of knowledge about technology, costs, "best-practices," efficiencies, and the value of cooperation. Such effects of knowledge creation and sharing would make it easier and more effective to manage the healthcare organization.

Finally, the role of knowledge management is especially crucial in the *interface* between the clinical and administrative functions. By and large these two categories of activities are separated by differentiations such as professional specializations, role in the organization, and goals and standards of practice. Hence, there is a tendency to avoid sharing knowledge and exchanging experience-based lessons so as not to upset the existing balance of power of the organization.

4.0 BARRIERS AND FACILITATORS TO THE ADOPTION AND IMPLEMENTATION OF KNOWLEDGE MANAGEMENT IN HEALTHCARE ORGANIZATIONS

There are four categories of barriers to the adoption and implementation of knowledge systems in healthcare organizations. The first is *technology* factors. These barriers are: (1) the attributes inherent in the technology, such as *compatibility* with other systems, *complexity*, and *trialability*; (2) *applicability* to the task for which the technology is being adopted; (3) *ease of maintenance*; (4) *quality* (in terms of errors, breakdowns, and non-responsiveness); and (5) *ease of updating or replacement*. Relative *ease of use* will impact the degree of implementation of the technology. Technologies that are very complex, not compatible with existing systems, or hard to maintain and to update or replace will be more difficult to adopt (Fichman and Kemerer, 1999; Kaplan, 1987).

The second category of barriers is the set of *organizational* barriers. These include the traditional barriers to technology adoption, such as political rivalries, lack of senior management support for such technology and innovation, and prior experience of the organization with similar types of technologies and their implementation. Unsuccessful past events tend to hinder any current attempts to adopt and implement technology.

In healthcare organizations there is also the added burden of the differences among organizational units in their assessment of needs for the technology and the hindering effects of the high specialization of clinical departments. The reality in such organizations is a considerable differentiation in how needs are assessed and what they mean to other units across the organization. Difficulties in establishing systemic value for a technology will hinder its adoption and implementation. Unless the technology under consideration has a wide appeal to a variety of clinical specialties (e.g., a diagnostic innovation), there will be resistance from other units and specialties to the adoption of a technology whose perceived value is restricted to a single clinical specialty (Scott et al., 2006).

A third category is *human factors*. These include cultural barriers, a complex learning curve needed to implement the technology, and unfavorable perception of the role of the technology, its value to the organization, and its chances of successfully contributing to tasks and goals of the organization Brender et al., 2006; Martens and Goodman, 2006).

In the healthcare environment there is also the impact of barriers inherent in the technological aptitudes of the clinical personnel, and their attitudes towards technological innovations in the practice of medicine (Laupacis, 1992). The usual formula for adoption of technologies by medical professionals is to follow other industries where such technologies have been implemented and successfully diffused. Only then would healthcare organizations assume the risk of adoption and their clinical personnel would be willing to adopt and implement.

The fourth and final set of barriers is the *economic factors* of the cost and cost-benefits of the technology. In the healthcare delivery environment capital expenditures for costly technological innovations are evaluated with extra care. An excellent case must be made for the value to be derived from the adoption of the technology before the purchase is authorized. It is less arduous for healthcare organizations to approve and adopt less costly technologies with widespread use in the organization.

4.1 Facilitators to Adoption and Implementation

The factors that seem to facilitate the adoption and implementation of healthcare technology are not necessarily the inverse or lack of barriers. They are affirmative factors that act to make the adoption and the implementation processes more feasible.

Two categories of these facilitating factors can be described. The first is the pressures that the external environment imposes on healthcare delivery organizations (Wickramasinghe and Reddy, 2006). This includes such factors as the requirements imposed by payers and regulators for billing and reporting purposes. These requirements may be based on administrative and clinical procedures and methodologies that must be made possible with the adoption and implementation of innovative technologies. Thus, healthcare delivery organizations would feel compelled to act and to facilitate the adoption of these technologies.

The second category includes factors inherent in the processes of healthcare delivery and in the perceived need to make them more productive and more efficient. For example, medical errors are embedded in the processes of healthcare delivery. This

problem may trigger and facilitate the adoption and implementation of technologies, whose purpose is to alleviate the problem (Institute of Medicine, 2001).

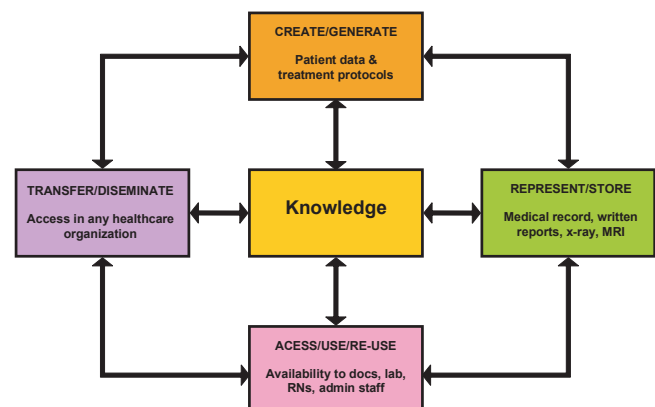
Another example includes the need to make procedures more efficient, due to such economic realities as "capitation," DRGs (Diagnosis Related Groups), and "managed care." When payors set limits to reimbursements for diagnoses and treatments, hospitals will explore ways to be more efficient and to reduce the cost of practice of medicine. Technology becomes one of the solutions, hence the impact of this situation as a facilitator of the adoption and implementation of healthcare technologies (Shakeshaft and Frankish, 2003; Nykanen and Karimaa, 2006; Kaplan, 1987).

5.0 CLINICAL EXAMPLE: OPERATING ROOM

The orthopaedic operating room represents an ideal environment for the application of a continuous improvement cycle that is dependant on the application of the tools and techniques of KM. For those patients with advanced degeneration of their hips and knees, arthroplasty of the knee and hip represent an opportunity to regain their function. Before the operation ever begins in the operating room, there are a large number of interdependent individual processes that must be completed. Each process requires data input and produces a data output such as patient history, diagnostic test and consultations. From the surgeon's and hospital's perspective, they are on a continuous cycle of addressing central issues regarding access, quality and value at the micro level, or individual patient level, as well as at the macro level, or monthly/yearly target level. The interaction between these data elements is not always maximized in terms of operating room scheduling and completion of the procedure. Moreover, as the population ages and patient's functional expectations continue to increase with their advanced knowledge of medical issues; reconstructive Orthopaedic surgeons are being presented with an increasing patient population requiring hip and knee arthroplasty. Simultaneously, the implants are becoming more sophisticated and thus more expensive. In turn, the surgeons are experiencing little change in system capacity, but are being told to improve efficiency and output, improve procedure time and eliminate redundancy. However, the system legacy is for insufficient room designs that have not been updated with the introduction of new equipment, poor integration of the equipment, inefficient scheduling and time consuming procedure preparation. Although there are many barriers to Re-Engineering the Operating Room such as the complex choreography of the perioperative processes, a dearth of data and the difficulty of aligning incentives, it is indeed possible to effect significant improvements through the application of the KM. Figure 2 outlines critical KM steps that become important in such a setting

The entire process of getting a patient to the operating room for a surgical procedure can be represented by three distinct phases: preoperative, intraoperative and postoperative. In turn, each of these phases can be further subdivided into the individual yet interdependent processes that represent each step on the surgical trajectory. As each of the individual processes are often dependant on a previous event, the capture of event and process data in a data warehouse is necessary. The diagnostic evaluation of this data, and the re-engineering of each of the deficient

Figure 2. The key steps of knowledge management



processes will then lead to increased efficiency. For example, many patients are allergic to the penicillin family of antibiotics that are often administered preoperative in order to minimize the risk of infection. For those patients who are allergic, a substitute drug requires a 45 minute monitored administration time as opposed to the much shorter administration time of the default agent. Since the antibiotic is only effective when administered prior to starting the procedure, this often means that a delay is experienced. When identified in the preoperative phase, these patients should be prepared earlier on the day of surgery and the medication administered in sufficient time such that the schedule is not delayed. This prescriptive reengineering has directly resulted from mining of the data in the information system in conjunction with an examination of the business processes and their flows. By scrutinizing the delivery of care and each individual process, increased efficiency and improved quality should be realized while maximizing value. For knee and hip arthroplasty, there are over 432 discrete processes that can be evaluated and reengineered as necessary through the application of a spectrum of KM tools and techniques (Wickramasinghe and Schaffer, 2006).

In terms of the four major categories of barriers and facilitators we identified earlier the case vignette of the operating orthopaedic OR exhibits instances of all of these. In each stage from pre-operative, intraoperative and finally postoperative various clinical and administrative technologies are necessary. By adopting the spectrum of KM tools and techniques what we find is that it becomes easier to monitor and evaluate these various technologies in action which in turn results in more effective use of the technology and efficient surgeries with heightened results. The continuous improvement also facilitates enhanced co-ordination between the various people, from surgeons, to nursing staff and even the patient, involved throughout the pre-operative, intraoperative and postoperative stages; once again with the result of superior operations and the achievement of the six quality aims outlined by the American Institute of Medicine (Institute of Medicine, 2001) and hence addresses many of the human and organizational barriers. Finally, in terms of economic factors, more efficient and effective performance as measured by faster throughput, higher quality and superior results together leads to a decrease in costs which are to a large extent due to the cumulative additive effect of various inefficiencies (Wickramasinghe and Schaffer, 2006).

6.0 DISCUSSION AND CONCLUSION

The preceding discussion has served to highlight the significance and key role for knowledge management in healthcare today. Specifically, this was done by discussing some of the major challenges facing healthcare today in terms of demographics, technology and finance and how KM tools and techniques might help to ameliorate this situation. In addition major barriers and facilitators were identified that must be considered when trying to implement an appropriate KM solution in healthcare. Finally, an example of how beneficial the incorporation of such a perspective is in redesigning the current state of the orthopaedic OR to a future state of the OR was given. Taken together then, this paper serves to under score the importance of taking a holistic approach to addressing the challenges currently faced by healthcare. Furthermore, by focusing on diagnosing the current state and then finding appropriate solutions so it is possible to prescribe strategies to make the key inputs into the healthcare information system more effective and efficient it will then be possible to realize the value proposition for healthcare. While medical science has made revolutionary changes, healthcare in contrast has made incremental changes at best. The disparity between these two is one of the major reasons why today's healthcare industry is faced with its current challenges. We believe that by embracing the tools and techniques of KM it will be possible for healthcare to make evolutionary changes and thereby meet patients great expectations.

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