Knowledge Management for Healthcare Organizations: Comparing Strategies with Technical Support

Biswadip Ghosh
Dept. of Computer Information Systems
Metropolitan State College of Denver
bghosh@mscd.edu

Judy E. Scott
Business School
University of Colorado at Denver
judy.scott@cudenver.edu

Abstract

Healthcare organizations are increasingly adopting Knowledge Management Systems (KMS) for clinical use, which have been established in technical support organizations for several years. While a technical support organization can utilize its KMS to directly address customer needs using its infrastructure and established processes, the effectiveness and success of KMS in a healthcare organization relies on the collective practice of healthcare professionals. In this research, the knowledge management processes and infrastructure in the two industries is compared. Seven hypotheses are developed and tested using a survey in two organizations, one in each industry to measure the contributions of different components of knowledge management infrastructure and processes towards organizational effectiveness. The results indicate that culture plays a larger role than structure in healthcare. Knowledge acquisition processes are more important in healthcare, compared with conversion and application in technical support. These results have implications for the selection and implementation of KMS in Healthcare.

1. Introduction

The use of knowledge management systems (KMS) in healthcare organizations is on the increase. Among the reasons for this trend are pressures to reduce costs, which have been growing at an unsustainable rate [25] and to improve the quality of healthcare [14]. KMS, such as the just-in-time KM at Partners HealthCare [8] and the computerized physician order-entry system at CareGroup [25], have the potential to reduce medical errors, which cause an estimated million injuries and 98,000 deaths each year. Also KMS can reduce costs and help healthcare professionals to cope with information overload and bring current research developments into practice. The technical support industry has been an early adopter of the use of IT, such as CRM, ERP, portals and case based expert systems to achieve organizational goals through knowledge management. Healthcare organizations are pursuing or planning the adoption of a similar list of KM technologies, fostering a revolutionary IT trend in healthcare, which is superseding the earlier focus of IT adoption in healthcare for administration, cost containment, facilitation of insurance and billing compliance [2]. To facilitate a more effective cross-adoption of the above KMS, information systems (IS) research needs to understand the structure of healthcare organizations, how they differ from technical support organizations, what the key components of a KMS are and specific system features that may benefit such organizations. A comparative study of KMS in technical support and healthcare organizations has not been attempted in IS literature and can help our understanding of the commonalities and differences between the two.

1.1 Organizational Structure

Healthcare organizations are designed quite differently from technical support organizations and function differently as well. Such organizations fall into the category of adhocracies [23]. Healthcare organizations have highly organic structures with limited formalization of behavior, where jobs and departments are highly specialized and autonomous. Highly trained specialists are grouped into functional units for “housekeeping” purposes, but are deployed to work in teams as patient cases arise. The coordination among units and departments is handled through mutual adjustment and mostly informal communications. Moreover, the staff functions in a healthcare organization are particularly weak and adoption of technologies is highly dispersed as the work differs within each functional specialization. Integrating these “islands” of care is, however, a high priority [10] because it can foster collaboration among groups of healthcare providers and can improve healthcare outcomes.

Technical support organizations, on the other hand, have more stable and repetitive work, where skills can be standardized and technology can be put in place to drive efficiencies in the work processes. Such organizations can be classified as machine bureaucracies, where the technology infrastructure and associated analysts and support staff are critical components, and help to standardize skills and formalize processes across units using complex systems [23]. Coordination is achieved via "regulated" activity and formal authority via hierarchy. Clearly, a machine bureaucracy structure allows easier centralized planning, design and deployment of information systems to support cross unit activities such as knowledge management.

1.2 Research Goals

The objective of this study is to understand and compare the KM processes and infrastructure in two organizations in the two industries – healthcare and technical support and to describe their knowledge management processes and identify the key contributors to the organizational effectiveness of KMS. The areas of investigation in this research that have not been considered in previous studies are:

1. Performing a cross industry comparative study of KM at the knowledge worker level in the two industries – healthcare and technical support.
2. Measuring and identifying the most important components of KM processes and infrastructure for the two organizations.
3. Understanding the characteristics of knowledge management systems needed to support the nursing function.
4. Understanding what systems and policies can be used for successful KMS adoption in healthcare organizations.

This study focuses on the role of KM in the clinical nursing function in a round-the-clock teaching hospital. While, the physician has responsibility for diagnosis and prescription of the patient's conditions and ailments, the nurse makes significantly more contact with the patient. During the patient's stay in the hospital, therefore, the interactions between the nurse and the patient are extremely important knowledge acquisition and dissemination events. The nurse often identifies new symptoms, changed conditions and critical issues during these interactions. This knowledge is then used by the nurse in clinical interactions with other clinical practitioners involved with the patient's care, and is also presented to the physician, who may order additional tests or change the medical diagnosis and care prescription. It is again the role of nursing to carry out the patient's care plan as prescribed by the physician.

2.0 Theoretical Background

The concept of a KMS is a system that allows for the creation, storage, transfer and application of knowledge in an organization [15]. Several factors and variables have emerged as contributors to the organizational study of knowledge creation and sharing. Knowledge processes typically fall in the categories of knowledge acquisition, conversion, application and protection [12], [13].

[22] identify knowledge enablers as the factors that provide the infrastructure necessary for the organization to increase the efficiency of knowledge processes, separately from the knowledge processes themselves. Their study showed definite impact of these two categories of KM factors – "the processes" and "the process enablers" on organizational performance. However, the study did not go as far as to evaluate the most important components of KM process and infrastructure and measure the translation of these towards organizational performance gains.

Organizations vary by the nature of their knowledge infrastructure and knowledge processes. It is seen that for knowledge held by individuals, the organizational culture plays a big role in the individual's propensity to create the knowledge and then share it with others [22]. This approach to KMS relying predominantly on culture is known as the personalization strategy [16]. Several research papers have studied the relationships between the different enablers – structure, culture and the infrastructure in different organizations in different industries [4], [5], [26]. However, prior research lacks a cross industry comparative study of KM between technical support and healthcare. With the growing trend of adoption by healthcare organizations of systems for KM that have been successful in technical support organizations, such a study is necessary.

[10] highlights the concept of a knowledge stock like databases versus knowledge flows that create shared contexts. Extending the study of shared contexts, [26] demonstrates the importance of understanding the patterned interactions in an organization's activity system as an important consideration in the

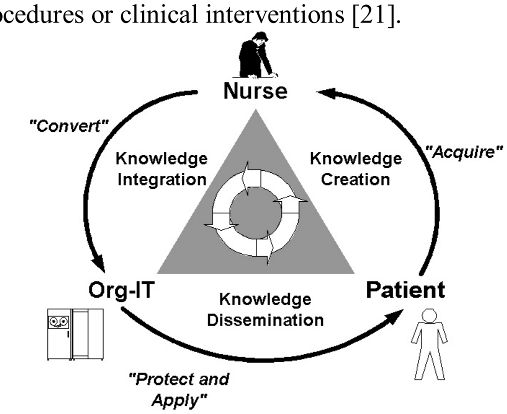
implementation of KM initiatives. This study found that expected changes in the activity system take place when careful attention is paid to the roles of the KM infrastructure and the KM processes. A study that identifies and compares the components of the activity systems across technical support and healthcare is necessary as systems are adopted across these industries.

Other studies have taken the approach of studying the knowledge worker task orientations. Using strategic management and organizational theories to understand the impacts of the concept of task orientation is a key differentiator for organizations, which can be categorized as either content oriented or process oriented [3]. The results show that the former organizations focus on the "*know what*" or declarative knowledge, while the later organizations emphasize the means to attain the goal of "*know how*" or the procedural knowledge. Performing tasks that are "broad" in domain emphasize the interactions among the actors, while the tasks requiring "deep" knowledge emphasize the use of databases and repositories. Therefore it is necessary to compare and understand the factors and processes contributing to KMS in different organizations at the knowledge worker level by applying a comprehensive KM evaluation model, such as that presented in [13].

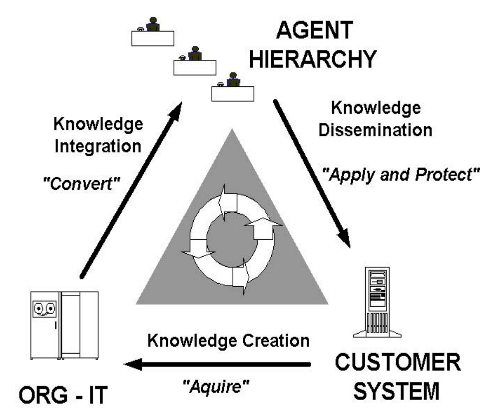
3.0 KM Processes in Healthcare and Technical Support

In healthcare organizations, for the nursing functions the key KM transaction is between the professional (the nurse) and the patient (customer). The organization's role is to provide the IT and systems environment to achieve efficiencies by facilitating knowledge management. Knowledge is created during the interaction between the patient and nurse and may be stored in the KMS by the nurse. The knowledge is then available to other nurses in future patient interaction scenarios (See Figure 1a). Healthcare falls into the category of professional organizations and the industry is an "Agent Industry", where transactions are highly standardized [21]. Clinical activity involves a very high degree of knowledge acquisition and creation in the problem identification stage. The interactions between the nurse and the patient are the drivers of this knowledge creation, yet the information going back and forth is often non-standard.

The response (i.e., transaction) from the nurse as a result of this interaction is usually a standard set of clinical activities such as tests and procedures. Moreover, nursing processes and products are likewise very standardized across the profession and each institution adopts a tailored version of the nursing function. This tailoring is the result of different areas of excellence for the hospital or a different patient base. In hospitals, therefore, the nursing processes are tailored customizations to deal with different environments and patient pools; yet the ultimate transaction is very much standardized – a set of diagnostic tests, medical procedures or clinical interventions [21].



(a) KM Processes in HealthCare



(b) KM in Technical Support

Figure 1. Comparing Knowledge Flows in the two types of Organizations

In technical support organizations, the knowledge creation transactions are between the organization and the customer, with the service agent playing the role of the integrator. The organization captures the knowledge from the customer in standardized transactions (eg. the use of SNMP – Simple Network Management Protocol Traps and MIB's - Management Information Base - to collect system information) and then it is the job of the technical support agent to utilize that knowledge in a customized way to address the specific needs of the customer. Thus while the knowledge capture is done by the organization; the use of the knowledge falls into the realm of the agent (see Figure 1b). The support agent is heavily dependent on the correct codification of the knowledge by the organization as collaboration among agents is limited.

One of the goals of the technical support organization is to use KM to limit escalations of trouble shooting activity from lower tier technical support agents to higher tier agents. The goal is to contain costs by minimizing the time spent on the problem by the higher tier agents with higher salaries. When a problem occurs at the end customer's site, the job of the technician is to shift through all the site specific knowledge in the KMS and create a customized solution for the end customer. An example response may be the upgrade of software to the next compatible version. Thus the transaction is customized based on the unique customer configuration. In other words, technical support involves customizing transaction yet utilizing the purely standardized knowledge and service offers provided by the organization. Technical support organizations are characterized as *"Bulk Industries",* where the data is standardized but the transactions are customized [21].

4.0 Research Framework and Constructs

Several frameworks have been proposed in the IS literature to study the processes in knowledge management [12], [19]. These frameworks categorize knowledge management into process flows of different knowledge activities, such as knowledge creation, codification and storage, protection, dissemination and use.

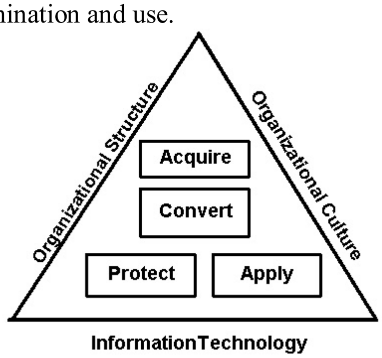


Figure 2. KM Process and Infrastructure Components

These frameworks also look at the knowledge cycle based on the use of knowledge in either recognizing or solving new or previously solved problems. The Knowledge Management Capabilities and Organizational Effectiveness (KMCOE) model in [13] has modeled the impact of the "process enablers" (Knowledge Infrastructure Capabilities - KIC) and the "knowledge processes" (Knowledge Process Capabilities - KPC) on the organizational effectiveness of the organization. These factors are illustrated in Figure 2.

4.1 KIC – Structure, Culture, Technology

The knowledge management infrastructure is defined as the structure, culture and technology deployed in the organization to support KMS [13]. They constitute the enablers of a KMS and support the KM processes. The role of infrastructure in supporting KM initiatives varies for different categories of organizations [20]. Studies have found support for these enablers on KMS effectiveness and these enablers must be matched based on organizational characteristics.

The structure of the organization is defined as both the formal structure and the "informal" structure of how work gets done in the organization [23], [13]. [24] points out that the logical structure of how work is accomplished in an organization is very different from what the organization chart documents. The informal structures together with organizational cultures impact the functioning of the organization, which is evident in the domain of knowledge management as well [18].

Organizational culture represents the interactions and contacts that enable building and sustaining relationships [13]. They are the goals and values of the organization and can either support knowledge sharing or hinder it. Cultural factors, such as levels of participation, encouragement to explore, learn and discuss work with others are key drivers of knowledge sharing processes in organizations.

The technology infrastructure is defined as the collection of systems within an organization to support the knowledge processes. The selection and deployment of technology needs to match the characteristics of the work in the organization [13].

[20] characterizes KM systems for organizations that are product based versus service based and by the knowledge context volatility. Under their classification, healthcare would fall in the service based high volatility quadrant, while technical support would be product based with low volatility. This implies that KM technologies for healthcare need to

support the KM culture of mutual interaction and provide vehicles for professional interactions, while capturing knowledge and best practices from the clinical activities of the professionals. The emphasis of the IT should not be "too focused" on an expert-driven codification approach, as that would not be capable of dealing with the highly tacit and distributed organizational knowledge and decentralized operations so prevalent in clinical healthcare settings [17].

4.3 KPC – Acquisition, Conversion, Application, Protection

Knowledge Process capabilities are defined as organizational processes that allow the firms to create, exploit and protect knowledge assets [1], [8]. [13] identified a set of knowledge management processes that an organization utilizes to transfer and exploit knowledge from internal and external sources. There are four interrelated processes that are critical for managing knowledge synergy: (1) creation or acquisition of knowledge, (2) integration or conversion of knowledge, (3) leverage or application of knowledge and (4) the protection of knowledge from misuse. New knowledge is "created" or "acquired" through specific activities such as training, interacting with patients/customers or through collaboration with other professionals. By "converting" the knowledge, the organization structures unstructured knowledge and makes it suitable for access and use. Then this knowledge can be quickly and easily accessed and be "applied" to other relevant scenarios.

Prior research has identified the differences in how organizations operationalize these knowledge processes. [11] outlined the differences between traditional and newer process models for knowledge management. In the traditional model the organization is in charge of the collection, structure and dissemination of the organizational knowledge. This is clearly the case of technical support. The management and support analyst staff are responsible for the planning and implementation of knowledge assets and designing processes to "encourage" call center agents to use the knowledge assets.

The newer KM process model emphasizes the predominantly important role of the "knowledge workers", who are reflective practitioners, who understand and solve ill-defined problems and create knowledge that can be reused throughout the organization [11]. This later KM process model is focused on problem identification and knowledge is just a side effect of the work performed. It is clear that the KM processes in healthcare resemble this newer KM model, which stresses more dynamic knowledge creation, while technical support follows the traditional model.

The traditional model is highly dependent on KM analysts, who define and deploy the KM technological infrastructure to create an organizational memory repository where users find their "answers" [11]. The traditional model has information spaces that are relatively static and closed and it emphasizes knowledge transfer rather than knowledge creation. In contrast, the dynamic knowledge creation model in healthcare is open and dynamic and is an on going process, where the goal is to encourage opportunities for new learning, new knowledge creation and innovation.

5.0 Research Model and Hypotheses

From the previous section, one can conclude that healthcare organizations are different from technical support organizations with respect to infrastructure and processes to support knowledge management. The Knowledge Management Capabilities and Organizational Effectiveness Model (KMCOE model) developed in [13] captures the relationship of the key infrastructure items – technology, organizational structure and cultural capabilities and knowledge process capabilities on organizational effectiveness.

The KMCOE model from [13] is well suited to measure the strength of the relationships between structure, culture and technology towards knowledge infrastructure capability as well as the relationships between acquisition, application, conversion and protection processes with knowledge process capability. This allows the identification of the most important contributors of knowledge management strategy for the organizations in the two industries. The model also measures the contributions of the two dimensions – processes and enablers towards organizational effectiveness.

Due to the differences in the flow and ownership of knowledge in the two organizations (Figure 1), the magnitude of the contributions of KM infrastructure and KM processes towards organizational effectiveness will be different for the two organizations. The KMCOE model with the research hypotheses are in Figure 3.

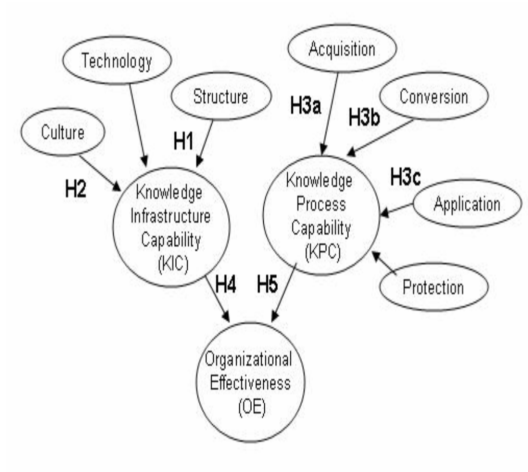


Figure 3: Research Model and Hypotheses.

5.1 KM Infrastructure

[16] identified a personalization strategy for KMS, which has greater emphasis on culture (e.g. healthcare organizations) verses a codification strategy with emphasis on infrastructure (e.g. technical support organizations). This is consistent with the findings of [26], that there are two types of knowledge processing – interactive and integrative. Moreover, the logical structure of how work is accomplished in an organization is very different from what the organization chart documents [24]. These informal structures can be extended to the knowledge management domain to see that a technical support organization relies on a hierarchy of personnel of different levels of expertise and the work "episode" is moved through the "chain".

In a healthcare organization, the clinical professionals usually work at the same level of expertise with "hubs" being formed to synthesize knowledge sharing differences in experience and domains of specialization. The structure of knowledge management in the Healthcare Organization will have less emphasis on the formal organizational structure, whereas in the Technical Support Organization there will be a greater emphasis on such structures.

H1: Structure will have a stronger relationship with Knowledge Infrastructure Capability for Technical Support organizations than for Healthcare organizations.

[1] presented a study conducted among executives from various industries found that culture based organizations (such as healthcare) focus more on collective processes while technology based organizations use intelligent systems and data stores to focus their knowledge management initiatives. Hence,

H2: Culture will have a stronger relationship with Knowledge Infrastructure Capability for Healthcare organizations than for Technical Support organizations.

5.2 KM Processes

The nurse is the professional entity responsible for the execution of the care plan of a patient admitted to a healthcare organization such as a nursing home or hospital. In performing those duties, nurses need to collaborate with other clinical professionals to obtain the knowledge used to identify and solve new patient needs. Therefore, in healthcare, the focus of knowledge management falls in the domain of knowledge acquisition in the identification and definition of new problems [12].

H3a: Knowledge Acquisition Capability will have a stronger relationship with Knowledge Process Capability for Healthcare organizations than for Technical Support Organizations.

In technical support organizations, the support agent's role is to be an intermediary in the transaction between the organization and the customer. Very likely the organization has already collected and deciphered the knowledge needed about the equipment. The technician has a routine set of procedures to apply the previously collected knowledge. If the problem is not resolved, then it is passed to the next higher-level agent in the "chain". Here the role of KM is to efficiently solve previously solved problems by suitable conversion and application of knowledge.

H3b: Knowledge Conversion Capabilities will have a stronger relationship with Knowledge Process Capability for Technical Support organizations than for Healthcare organizations.

H3c: Knowledge Application Capabilities will have a stronger relationship with Knowledge Process Capability for Technical Support organizations than for Healthcare organizations.

5.3 Organizational Effectiveness

In technical support organizations, knowledge processing is integrative. Integrative applications, rather than directly involving the personnel, allow for the sequential flow of explicit knowledge into and out of the KMS repository [26]. The primary focus of chain–based knowledge processing is not so much on the interactions of the contributors as on "integrating" the explicit knowledge residing in a KMS system [26]. Clear emphasis is placed on the organizational infrastructure to achieve KM goals in this scenario (technical support).

H4: Knowledge Infrastructure Capability will have a stronger relationship with Organizational Effectiveness in a Technical Support organization than Healthcare.

On the other hand, in healthcare organizations, because of the complexities involved with problem identification, knowledge processing is interactive and knowledge is tacit. Interactive applications focus primarily on supporting interactions among those people with tacit knowledge [26]. In contrast to integrative applications, the repository (i.e. KMS) is a by-product of interaction and collaboration rather than the primary focus of the application. Clear emphasis is placed on the organizational processes and interactions to achieve KM goals in this scenario (e.g. healthcare).

H5: Knowledge Process Capability will have a stronger relationship with Organizational Effectiveness in a Healthcare organization than Technical Support.

6.0 Methodology and Data Collection

A questionnaire was developed to conduct a survey in two organizations to test the hypotheses. The questionnaire has five items to measure each latent variable. All survey questions used a 7-point Liekert scale from strongly disagree (1) to strongly agree (7) with neutral as 4. All items were selected from [13] by identifying and discarding closely related items. [13] had developed between 10-14 items for each construct and included between 6-11 items per construct in their final measurement model. Our survey included 5 items for each construct by dropping similar items to increase power in anticipation of a smaller sample size. Care was taken to not hamper the content validity of the measures when items were dropped from the survey. The survey also had a set of demographic questions to compare the workers in the two organizations in how they interact (via email, telephone or face-face) with patients/customers and their coworkers and what percentage of their tasks require collaboration with a coworker and their daily computer usage. The survey can be obtained from the authors.

6.1 Organizations Surveyed

The healthcare organization selected is a large metropolitan area hospital with over 300 beds. Inpatient nursing staff consists of over 400 nurses. The hospital boasts centers of excellence in trauma and infectious disease care and is also a premier teaching hospital in the region. A total of 150 surveys were distributed to the nurses working on the medical and surgical departments at the chosen Hospital during the daytime shifts on a weekday. A total of 51 fully completed surveys were collected through a collection box over a two week period. The response rate was 34%. The technical support organization chosen is a multi-national company. The organization is a leader in the support of multi-vendor networking equipment, with capabilities including design, installation, monitoring and break-fix support. The center that is studied has 500 technical support personnel. A total of 150 surveys were distributed to the call center employees on the daytime shift on a weekday. A total of 103 fully completed surveys were collected after a 90 minute period through a collection box. The response rate was 68.6%. The grossly disparate response rates can be partially attributed to the irregular shifting work schedule of nurses and the lack of any follow up reminders to the nurses during the two weeks to complete the surveys. Moreover job demands grossly differ, as technical support agents were able to complete the survey between customer trouble calls at their desk; while nurses usually have no specific desk or cubicle, and often require prompt bed side visits to the patient's rooms on calls. This coupled with 2 or 3 day per week work schedules for the nurses, resulted in the vastly different response rates.

6.2 Demographics

The demographics are seen in Table 1. The nurses have on average 1.6 more years of education; indicating that a larger number of nurses may possess Bachelors degrees as compared to Associates degrees for technical support personnel. Moreover, nurses showed fewer years in the profession and on their current job, supporting the well known demographic that there is greater turnover among the nursing population.

Regarding their daily interactions with customers/patients; nurses use predominantly face to face communications while the technical support personnel use telephone communications. With regards to interactions with co-workers, nurses rely on predominantly face to face communications (76%) and some telephone communications (19%) but hardly any email. While technical support personnel use a combination of email, telephone and face to face communications. Again these observations are in line with the personalization strategy of knowledge management in healthcare with a reliance on personal interactions. The codification strategy, which relies on technology is evident in the technical support demographics. Finally the sample of nurses was 73% female while the technical support sample consisted of 67% males.

Table 1: Demographic Information for the Two Organizations

		Tech Support Mean, S.D	Health Care Mean, S.D.
Schooling (yrs)		14.14, 2.46	15.75, 1.611
Years on Job		5.51,3.35	2.88, 2.59
Professional Experience		8.44,6.48	6.22, 5.95
Daily Use of Computer		82.17%, 27.6%	8.59%, 9.74%
Task Collaboration		22.75%, 25.57%	65.20%, 19.16%
% of Pat-ient Com	Email	3.24%, 6.5%	0%, 0%
	Tel	93.88%, 16.21%	1.86%, 3.78%
	Face-Face	0.63%, 3.55%	95.98%, 14.39%
% of Inte-rnal Com	Email	20.61%, 24.18%	2.25%, 5.59%
	Tel	23.88%, 25.44%	19.65%, 12.68%
	Face-Face	43.17%, 33.65%	76.63%, 16.86%
Gender		M: 68, F:35	M: 14 F: 37

7.0 Data Analysis

A path analysis was done using PLS-graph to estimate and compare the strengths of the relationships between the latent variables. The version of PLS-graph used was version 0.3.0 build 1017. All items were modeled as reflective indicators of the latent variables.

To assess reliability and validity of the constructs, the block of indicator's composite reliabilities (CR) and the average variance extracted (AVE) were calculated. The following three rules were checked to ascertain validity and reliability when using PLS-Graph [6]:

1. The CR for each construct should be greater than 0.7 to demonstrate reliability.
2. The AVE measures the variance captured by the indicators relative to measurement error and should be greater than 0.5 to justify using a construct.
3. To demonstrate discriminant validity, the square root of each construct's AVE must also be greater than the correlation of the construct to other latent variables.

The results for the two organizations are shown in the Table 2. These tables indicate adequate scores in the CR and AVE measures to justify the reliability and validity of the measurement model for both organizations.

Table 2. CR and AVE for Constructs.

Construct	Healthcare		Tech Support	
	C.R.	AVE	C.R.	AVE
Technology	.93	.72	.92	.71
Structure	.85	.60	.89	.69
Culture	.84	.56	.81	.52
Acquisition	.91	.68	.71	.50
Conversion	.89	.64	.93	.72
Application	.94	.76	.92	.70
Protection	.89	.64	.88	.54
Organizational Effectiveness	.90	.65	.90	.64
KIC	.93	.55	.92	.52
KPC	.93	.50	.91	.51

The PLS-graph analysis also provides the path coefficients of the relationships among the latent variables. These coefficients are shown in Table 3. A bootstrapping procedure was used to generate t-statistics and standard errors to obtain the statistical significance of the path coefficients. All paths were found to be significant at the .01 level.

Table 3. Structural Model Results.

Path	Healthcare	Tech Support
Struc → KIC	0.87, .02, 33.36*	0.92, .02, 59.85*
Cul → KIC	0.89, .02, 31.07*	0.81, .03, 26.71*
Tech → KIC	0.93, .02, 47.03*	0.90, .02, 54.19*
Acq → KPC	0.85, .05, 15.95*	0.72, .03, 7.83*
Cnv → KPC	0.81, .04, 17.53*	0.93, .02, 60.51*
Apl → KPC	0.89, .02, 42.35*	0.94, .01, 87.31*
Prot → KPC	0.68, .07, 9.08*	0.71, .06, 12.53*
KIC → OE	0.75, .06, 10.92*	0.66, .05, 12.46*
KPC → OE	0.64, .07, 8.22*	0.63, .06, 10.26*

*p <.01

7.1 Smith-Satterthwait Tests

The Smith-Satterthwait test was applied to compare the significance of the differences in the path coefficients for the two organizations – tech support and healthcare. This test was applied as the variance for the two samples obtained from the two organizations were assumed to be different [7]. The value of the t-statistic for the test is given by dividing the difference in the path coefficients by the square root of the sum of squares of the standard errors (with m+n-2 degrees of freedom, d.f. = 103 + 51 – 2 = 152).

The critical t-values for significance are 1.28 (for $\alpha=0.10$) and 1.65 (for $\alpha=0.05$).

The results of the tests of the hypotheses are shown in Table 4. It is seen that 5 of the 7 results (except for H4) are directionally correct. In other words, if the theory predicted that a particular relationship would be stronger for the technical support organization than for healthcare or vice-versa, the results match the theory, with statistical support.

Table 4. Comparison of Relationships and Hypotheses Results.

		Path Coefficient Comparison Tests		
		T.S.	**Hlth**	**T-Val**
H1	Structure with KIC (Stronger for Tech Sup)	0.92	0.87	1.53** Support
H2	Culture with KIC (Stronger - Healthcare)	0.81	0.93	1.99* Support
H3a	Acquisition with KPC (Stronger for Healthcare)	0.72	0.85	2.16* Support
H3b	Conversion with KPC (Stronger for Tech Support)	0.93	0.81	2.76* Support
H3c	Application with KPC (Stronger for Tech Support)	0.94	0.89	1.44** Support
H4	KIC with OE stronger for Technical Support	0.66	0.75	1.05***
H5	KPC with OE stronger for Healthcare	0.63	0.64	0.375

* $p < 0.05$; ** $p < 0.10$; *** $p < 0.15$

Note that hypotheses H1 (structure) and H3c (application process) were significant at the 0.10 confidence level, while H2 (culture), H3a (acquisition process) and H3b (conversion process) were significant at the 0.05 confidence level. Note that hypothesis H4 (infrastructure capability) significant at the 0.15 confidence level, but directionally reversed. The reversal of H4 suggests that knowledge infrastructure capability is an important factor for successful KMS in healthcare organizations. Hypothesis H5 (process capability) was not significant.

8.0 Discussion and Implications

In summary, Table 5 shows the implications of the organizational KM enablers and the process capabilities necessary for KM success in the two organizations. It is seen that the results provide support for the theory developed.

This study posits that the selection and application of KM systems and tools rely heavily on the correct matching of KM enablers and the contributions of the systems. When healthcare organizations deploy KM tools that they adopted from technical support organizations, they need to keep in mind the different strategies for KM. Systems that reduce the personalization activities of a clinical worker are not likely to meet with success. The characteristics of the IT needed in the two organizations are clearly different. KM Systems (e.g. SMS- Short Message Service) that encourage involvement of nurses, doctors and the pharmacy in collaboration will be better adopted in healthcare while the KM systems in technical support must promote individual trouble shooting work by the engineers, with interactions only during problem escalations.

Table 5. Important Contributing Factors towards KMS in the Organizations.

	Healthcare	**Tech Supt**
KM Enablers	Culture	Structure
KM Processes	Acquisition	Conversion, Application

The results further support the proposition that healthcare organizations need to invest more in structure and process improvements. Any investments that can move the organization towards a professional bureaucratic [23] structure, will foster better formalized collaboration among functional departments. The end result will be more holistic treatment of patients, rather than focusing on individual physiological systems at a time. A full-blown clinical computing system, while enormously expensive, has the power to make revolutionary changes in healthcare quality by integrating patient knowledge acquisition and supporting the need for better ailment identification and treatment..

Coupled with such investments in cross departmental enterprise systems, training, certifications and standardization of skills and processes must be pursued in the healthcare organization to create a professional structure, where "mutual adjustment" is not the primary coordination mechanism. Care must be taken to introduce the KMS in healthcare through enrichment of the clinical professionals, so that the tailored care processes suited to serving diverse patients is retained. A machine bureaucracy, similar to tech support can not be sustained in a healthcare organization. Rather the coordination should be through skills and process standardization. Moreover, KMS for healthcare should be modified to (1) increase the amount of personalization information captured, (2) provide real-time communications among practitioners, and (3) support knowledge acquisition and creation activities.

8.1 Limitations and Future Research

A limitation of this study is that only two organizations were surveyed. Clearly these two organizations may not be representative of the two industries. A larger follow on survey in more organizations is necessary to generalize these results.

9.0 References

[1] Alavi, M. and Leidner, D., "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues", MIS Quarterly (25:1), 2001, 107-136.

[2] Amolat, J.P. and Dragon, M.P., "The Investment Climate and IT Priorities in the Healthcare and Public Sectors", IDC Market Report, Document #26256, 2002.

[3] Becerra-Fernandez, I. and Sabherwal, R., "Organizational Knowledge Management: A Contingency Perspective", JMIS 18(1), 2001, 23-55.

[4] Bennett, R. and Gabriel, H., "Organizational factors and knowledge management within large marketing department: An Empirical Study", Journal of Knowledge Management (3:3), 1999, 215-225.

[5] Bierly, P. and Chakrabarti, A., "Generic Knowledge Strategies in the U.S. Pharmaceutical Industry", Strategic Management Journal, (17:10), 1996, 123-135.

[6] Chin, W.W., "Partial Least Squares is to Lisrel as Principal Components Analysis is to Common Factor Analysis", Technology Studies, 2, 1995, 315-319.

[7] Chin, W.W., "Frequently Asked Questions – Partial Least Squares & PLS-Graph" [On-line], 2004, Available: http://dis-ct.cba.uh.edu/chin/plsfaq/plsfaq.htm.

[8] Davenport, T.H. and Glaser, J., "Just-in-Time Delivery comes to Knowledge Management", Harvard Business Review, 2002, 107-111.

[9] Davenport, T.H., Javenpaa, S.L, and Beers, M.C., "Improving Knowledge Management Work Processes", Sloan Management Review, Summer, 1996, 53-65.

[10] Fahey, L and Prusak, L., "The eleven deadliest sins of knowledge management", California Management Review, (40:3), 1998, 265-276.

[11] Fischer, G. and Ostwald, J., "Knowledge Management: Problems, Promises, Realities and Challenges", IEEE Intelligent Systems (16:1), 60-72.

[12] Gallupe, B., "Knowledge Management Systems: Surveying the landscape", International Journal of Management Reviews, (3:1), 2001, 61-77.

[13] Gold, A.H., Malhotra, A. and Segars, A.H., "Knowledge management: An organizational capabilities perspective", JMIS, 18(1), 2001, 185-214.

[14] Grimson, J., Grimson, W. and Hasselbring, W., "The SI Challenge in Healthcare", Communications of the ACM (43:6), 2000, 49-55.

[15] Grover, V. and Davenport, T.H., "General Perspectives on Knowledge Management: Fostering a Research Agenda", JMIS, 18(1), 2001.

[16] Hansen, T., Nohria, N. and Tierney, T., "What's your strategy for Managing Knowledge?" Harvard Business Review, March-April, 1999, 106-116.

[17] Hislop, D., "Mission Impossible? Communicating and sharing knowledge via information technology", Journal of Information Technology, 17, 2002, 165-177.

[18] Hofstede, G., "Culture's Consequences", Sage Publications, Thousand Oaks, CA, 2000.

[19] Holsapple, C.W. and Joshi, K.D., "Knowledge Management: A threefold Framework", The Information Society, 18, 2002, 47-64.

[20] Kankanhalli, A., Tanudidjaja, F., Sutanto, J. and Tan, B.C.Y., "The Role of IT in Successful Knowledge Management Initiatives", Communications of the ACM, 46:9, 2003, 69-73.

[21] Lampel, J. and Mintzberg, H., "Customizing Customization", Sloan Management Review, (38:1), 1996, 21-31.

[22] Lee, H. and Choi, B., "Knowledge Management Enablers, Processes and Organizational Performance: An Integrative View and Empirical Examination", Journal of Management Information Systems, 20(1), 2003, 179-228.

[23] Mintzberg, H., Structure in Fives: Designing Effective Organizations, Prentice Hall, Englewood Cliffs, NJ, 1983.

[24] Mintzberg, H. and Heyden, L., "Organigraphs: Drawing How companies really work", Harvard Business Review (77:5), 1999, 87-100.

[25] Warner, M., "Under the Knife", Business 2.0, 5:1, 2004, 84-89.

[26] Zack, M. "Managing Codified Knowledge", Sloan Management Review, Summer, 1999, 45-58.