Contribution of Knowledge and Knowledge Management Capability on Business Processes among Healthcare Organizations

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Abstract

Advances in technology, regulations, and rapid rise in costs have generated a growing interest among researchers to explore the role of knowledge management in healthcare. While most studies have focused on information technology and medical informatics including electronic health records management, only a few have attempted to go beyond the clinical processes (patient diagnostics) aspects of healthcare. Core business processes in healthcare go beyond clinical and diagnostics care. Employee knowledge and organizational mechanisms of knowledge and process management are hypothesized to contribute to process performance. In this paper we present a field study of healthcare firms in the Midwestern region of United States. Applying existing theories on absorptive capacity,, goal setting, and goal commitment we model the relationships among relevant constructs and using PLS methods show that knowledge management capabilities and organization's commitment and focus on knowledge contribute to supporting business process performance.

1. Introduction

Centers for Medicare and Medicaid services, a federal government agency, predicts that by 2017, total health care spending will double to more than 4 trillion dollars a year, accounting for one of every five dollars the nation spends. Almost every one involved in health care will need to make tough choices in dealing with the projected rise in costs. As primary players in the sector, healthcare firms face choices of appropriate strategies and understanding and implementing relevant business processes that will determine the future of health care in the United States.

In their book, Prahalad and Krishnan [24] states that business innovations will emerge from exploring business processes and implementing these with supporting information technology. In order to make the business processes efficient and effective the firm needs to understand how knowledge related to the processes are integrated with their tasks and activities. While it is argued that process related knowledge can improve business process performance there is little empirical evidence to support this claim. Moreover, it is expected that core processes are knowledge intensive and that several enablers of knowledge management play a role in the success of these processes. Our empirical study explores the contribution of knowledge and knowledge management capability on business processes among healthcare organizations.

2. Motivation and Background

2.1. State of health care in the US

If there is one topic that has attracted the most attention in this political campaign, it is the state of health care in the US. Rising cost of health care is attributed to the decline of firm value, especially among older, legacy firms and industrial sectors. Rising health care costs are also imposing burdens on society at large and on the care providers. Increased regulations, procedures, and compliance requirements may have been the causes but firms involved in healthcare are also at fault for not focusing on their basic business processes. New regulations and compliance requirements such as the Health Insurance Privacy, Protection and Accountability Act (HIPPAA) require firms to redesign, retool, and reinvent their processes, including core and supportive processes.

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2.2. Issues and opportunities for innovation in health care

As Prahalad and Krishnan [24] highlight the case of ICICI in diabetes patient care and monitoring, innovations emerge when firms fully understand their processes and see the enabling role of information technology and knowledge flow. Many studies on healthcare innovations have focused on the use of electronic health records to address efficiency. Attempts by Google and Microsoft to create on-line health records repositories for patients are also minimal attempts at innovation. Healthcare involves multiple participants (care providers, physicians, pharmacies, insurers, employers, etc) and the processes can span multiple organizations and divisions. Attempts to manage these inter-organizational processes can be daunting but the task can be less daunting if a firm were to first focus on their business processes. It is within these processes that many of the innovations emerge.

2.3. Business Processes

Business processes are becoming increasingly complicated in this era of globalization. Any business process involves integration of multiple tasks and activities that include making requests, handling requests, placing orders, maintaining inventory control, determining production levels in an assembly line, long and short term planning, scheduling, and marketing etc. Since there are so many stakeholders involved in these processes, presenting the information to each of the stakeholders in a more customized way, so that all individuals involved can make an informed decision is becoming more of a requirement of information systems.

As business process management becomes prevalent, firms have increasingly appreciated the fact that past empowerment efforts to improve subunit performance and competitiveness have led to the creation of autonomous, high performance hubs with little sharing of process knowledge among them. Ghoshal and Gratton [9] observed that, in order to ensure success with business processes, firms need to more efficiently incorporate knowledge-sharing among managers of the hubs. Only then can firms reap the enhanced organizational capabilities and sustain performance improvements in these processes. As business process management has taken hold, several tools have emerged to assist in the development of event-driven process chains. Analyzing and validating the process chains have been particularly problematic, as formal theories and methods are few and far between.

2.4. Knowledge and Knowledge Management

Nonaka and Takeuchi [22] defines knowledge to comprise both tacit and explicit parts while others have defined knowledge along dimensions such as to their accessibility, symbolic representations, embodiment, and culture and many more [4, 35, 26]. The knowledge of an organization can be seen as consisting of the expertise of current employees, artifacts, operational data, warehouse data, and derived knowledge.

Knowledge Management is most commonly defined as the process of capturing, organizing, storing, sharing and making the individual and organizational knowledge accessible to members of the organization. Knowledge Management may consist of many methodologies however it implies the use of technological tools to locate and/or interpret such knowledge [12, 25].

2.5. Role of knowledge and knowledge management in business processes

Ahn and Chang [1] define process knowledge as knowledge associated with the activities performed in each stage of a value chain from inbound logistics to customer care. Knowledge is created when business processes are operated and shared with other processes [28]. Balancing a market-oriented strategy and resource-based strategy, Maier and Remus [19] present a process-oriented knowledge management strategy. This strategy defines a set of dimensions along which an organization could define its knowledge management. In order to apply the strategy, processes are categorized into three types, namely knowledge intensive (core), knowledge communication (service), and knowledge management [34]. Prior research has shown that an organization's core processes reveal a treasure house of knowledge with many benefits for the firm [33]. Also, process knowledge integrates the organizational knowledge assets together and enables the achievement of better financial and organizational and market performance [6].

A core process creates value for customer by integrating individual value chain activities and it

comprises a set of critically important activities that produce products and eventually determine the performance of a company. Ahn and Chang [1] argue that process knowledge would make the core process the most efficient and productive contributor to both the financial and organizational performance. Lee and Choi's [16] research of knowledge management in 58 firms showed that organizational performance is influenced by the use of knowledge as well as the appropriate enabling mechanism for knowledge use.

2.5.1. Enablers of KM. Leadership, culture, human resource management (HRM) practices and IT infrastructure, skills, and culture which includes executive level support and creation of an environment where sharing of good practice is encouraged. Koumpouros et al. [14] examined the critical success factors for establishing a multidisciplinary health community KM system using Internet-based Information and Communication Technologies (ICT) and concluded that existence of a knowledge critical mass, political commitment and organizational endorsement, establishment of a well-structured ontology, multilingualism of the content and timeless processes and patient- and problem-oriented KM system. Other researchers have noted the role a community of practice plays in knowledge transfer and sharing, a set of key factors. In addition to these enablers, Scally and Donaldson [30] refer to the tight coupling of clinical governance to KM thereby addressing the linkage between knowledge and process of health care. These issues were examined by [21]. Lenz and Reichert [17] report that knowledge management support of administrative and clinical processes enable healthcare professionals to specify and maintain task specific knowledge.

In support of the position that knowledge enabled processes would be essential for modern health care organizations, Stefanelli [31] proposed a framework to bring together knowledge and process management theories, methods, and technologies that are potentially effective in building high performance health care organizations. While empirical and conceptual work examining the role of knowledge management in healthcare have often focused on the individual components, little work seems to exist that addresses the direct relationship between knowledge management and process performance in this sector [23, 8, 2, 3, 29, 36]. Meixell et al. [20] used simulation to study the value of knowledge as it contributed to a specific process in the supply chain. Their results showed that knowledge contributed to better operations of the process tasks.

3. Research Model

As described in the previous sections, prior research has shown that knowledge contributes to better organizational performance. While direct measurement of knowledge is difficult, these studies support the notion that enabling knowledge use through appropriate knowledge management in executing business processes is beneficial. Since knowledge is primarily embedded in the human and through their social interactions knowledge also gets embodied in the community [11]. The knowledge, tacit or explicit, therefore contributes to the process performance. Prior research has also supported the notion that there may be positive impact on organizational performance when employees are well aware of their organization's knowledge goals and these goals are linked to the process performance [32]. The proposed research model shown in Figure 1 integrates the following notions:

- Knowledge Management (KM) Capability - The ability of an organization to make use of critical knowledge. Three important aspects are the availability of a core set of knowledge, the appropriate attitude of management and staff, and the technical ability to support their knowledge resources.

- Knowledge Management (KM) Goals - The goals that the organization sets for using knowledge in its core business operations.

- Knowledge Management (KM) Commitment - The level of support the organization gives to knowledge management.

- Business Process (BP) Performance - The performance of an organization's core business processes.

Goal theory [18] lies at the center of the proposed research model. The theory states that setting high goals for the incorporation of knowledge into an organization's core business processes will improve the performance of the processes provided that such gains are possible [15]. The knowledge management capacity of the organization is a critical variable in whether or not the organization believes in its ability to meet the goals. Knowledge management capacity relies on absorptive capacity theory [5] in order to have such a positive effect on

an organization's attitude. The level of commitment an organization has to managing its knowledge is important to the type and level of knowledge management goals that it will set. Klein et al. [13] have shown that goal commitment has a strong positive effect on performance.

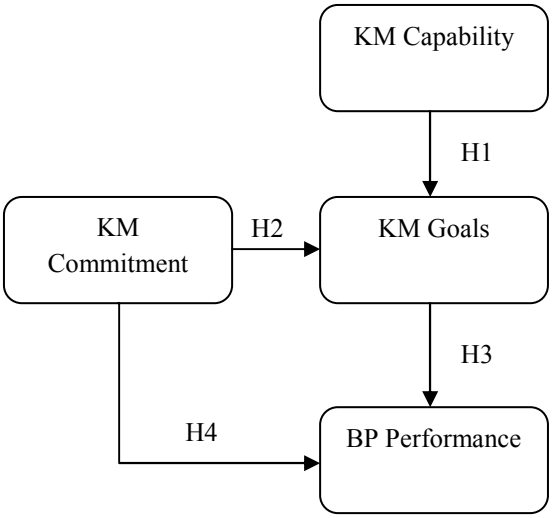

Figure 1. Research Model

3.1. Hypotheses

The model shown in Figure 1 provides the basis for four hypotheses:

- H1: The knowledge management capacity of an organization influences the knowledge management goals that it sets.
- H2: The knowledge management commitment of an organization influences the knowledge management goals that it sets.
- H3: The knowledge management goals that an organization sets mediate the influence of knowledge management commitment on the performance of its core business processes.
- H4: The knowledge management commitment of an organization influences the performance of its core business processes.

The four hypotheses (H1-H4) are supported by the work on goal theory [18] and absorptive capacity theory [5]. Absorptive capacity theory [5] tells us that organization's ability to recognize new information, understand it, and use it for the betterment of the organization depends on the organization's capacity. In the research model, this implies that knowledge management capacity will influence the type and difficulty of the goals that will be set (H1). The level of commitment of the organization will also have an impact on the type and difficulty of the goals that the organization will see as plausible goals (H2). The third hypothesis (H3) is supported by the work on goal theory [18]. The key issue for this hypothesis is that setting high goals results in a higher level of performance as long as the organization's staff and management view the goals as attainable [15]. As a result, it is necessary for H3 to be mediated by the organization's capacity. Finally, the fourth hypothesis (H4) is supported by the work on goal commitment [13]. The work by Klein et al. [13] shows that goal commitment has an influence on performance.

.3. Methodology

Measures related to the research variables were adapted from previously validated research instruments [7] as well as independently constructed. Respondents for the study were selected from D&B Million Dollar directory using the following criteria, namely, firms must belong to the health care industry classification, must have at least 10 employees, and are situated among the states of Iowa, Illinois, Minnesota, Missouri, and Nebraska. This yielded a total of 584 firms. After removing obvious duplicates we arrived at 560 firms. A key informant, either the top executive such as CEO, President, or CIO was identified from the list, and a package containing the questionnaire, a business reply envelope with a unique mail code, and a cover letter informing them about the goal of the study and soliciting their participation was mailed. Subsequently, a month later a reminder including the firm's unique mail code was mailed to non respondents. The card included a link to a web site that hosted the same questionnaire so that responses could be collected on line. Respondents were asked to enter their unique mail code on their on-line response. Our data collection methodology is similar to [32]. Twenty of the mailings and reminders were returned undelivered. At the end of these two events, 31 responses were returned giving a response rate of nearly 6%. Table 1 shows the measures and the variables (factors) to which these are associated.

3.4. Analysis

First, a factor analysis of the responses was performed using the principal components method with a varimax rotation and forcing a three factor solution. The loadings of items along the three factors of knowledge management capability, knowledge management commitment, and knowledge management goals supported our theoretical basis for these constructs. Factor analysis also helped in refining the list of items to retain as measures in the measurement model of the partial least squares (PLS) model. In testing relationships among the factors, the PLS model is more robust at small sample sizes than general regression models [10]. The construct on business process performance was independently verified through a separate factor analysis. Table 1 shows the factors, their respective items and loadings. The table also shows the reliability (Cronbach's alpha) for each set of constructs. The square root of the average variance extracted (AVE) for these constructs are also shown and it may be noted that majority of the correlations among the constructs are lower than their AVE value, thus supporting both discriminant and convergent validity of the constructs.

The data set was prepared as per the SmartPLS [27] program requirements with missing values replaced by means. We formulated the model to be reflective. The initial run of the model yielded strong support for the predicted relationship. The model was run using bootstrap sample of 5000. The t-statistic of the relationship remained consistent over several bootstrap iterations suggesting that the model is quite robust. The final model is shown in figure 2.

The reflective items for the latent variables are significant at 0.01 level or below and as the model shows, the path coefficients for the structural model are also significant. The full model has an r-square value of .677 and is significant. H1, the hypothesis that knowledge management capability influences the setting of knowledge management goals, is supported ($p <= .05$). Likewise, commitment to knowledge management has a positive and significant effect on business performance ($p <= .000$) thus supporting H4. H2 and H3, commitment's impact on goals, the effect of goals on performance, are supported but not as strong as expected ($p <= .01$). These relationships being significant while the direct effect of commitment on performance is also significant reduces the mediating effect of goals on performance – again if we set a higher criterion for significance.

3.5. Discussion

Our hypotheses are supported. While knowledge is difficult to measure directly, the contribution of knowledge to business process performance could be measured. The more knowledge an employee has about the processes, the better they are able to contribute to the performance of the process. Moreover, when the organization or top management sets goals and have them known to the employees performance is enhanced. As Locke [18] points out, goals enable employees to adopt appropriate strategies to execute the tasks efficiently. We find support for the relationship between KM commitment and KM goals from prior studies on goal commitment and goal setting. Prior studies have also shown that there would be strong relationship between commitment and performance, a finding we also have. We have postulated that there would be a mediating effect of goal setting on the influence of commitment on performance. We have only marginal support as can be seen from the significance of the direct and mediating associations. A detailed analysis requires more data and we hope to complete that once additional responses are available. The relationship between knowledge goals and knowledge management capabilities are also supported. Our findings are consistent with prior research on absorptive capacity of the firm and goal setting. Organizational resources and mechanisms and the use of social capital within the firm enhance the visibility and permeability of the goals.

3.6. Conclusion

We present a preliminary examination of the argument that knowledge management can influence business process performance. We focused on the healthcare sector because there is ample evidence to show that healthcare processes need much needed attention. We are at an early stage in our exploratory research. An additional refinement to the instrument and larger sample is needed to further expand and explain the theoretical bases of our study, namely the use of goal setting, goal commitment as predictors of KM success. We chose PLS to do the data analysis because of the small size of our data even though it lacks statistical power [10].

Table 1: Factors, item loading, factor correlations, reliability, and AVE

Factor	Item	Factor Loading	1	2	3	4	Rel	AVE
1. KM Capability	Units that perform similar activities use similar processes (BPClustr)	0.654		0.571	0.608	0.808	0.91	0.71
	Training required to manage process is provided (BPMTrg)	0.692						
	Process managers use performance data to manage their processes (BPMgmt)	0.744						
	Employees understand the importance of knowledge to firm success (EmKnow)	0.717						
	Employees participate in capturing and transferring knowledge (EmKCap)	0.546						
	Employees are encouraged to explore and experiment with knowledge resources (EmKXper)	0.775						
	Employees are encouraged to interact with other groups to share knowledge (EmKShare)	0.609						
	Employees understand that the benefits of sharing knowledge outweigh the costs (EmKBnft)	0.651						
	KM systems enhance the ability to bridge break in process steps (BPBrdge)	0.569						
	KM Systems improve sharing and producing work documents (BPDocSh)	0.633						
	KM systems improve sharing of collaborative workspaces (BPWSSh)	0.680						
	KM systems improve use of discussion and message boards (BPMsgBrd)	0.577						
2. KM Commitment	Firms's KM goal is to improve transparency (KFTransp)	0.479	0.571		0.590	0.792	0.82	0.66
	Firm's KM goal is to improve access (KFAccess)	0.683						
	Firm's KM goal is to improve innovation (KFInnovate)	0.477						
	Firm's Process improvement programs identify and address problems and defects (BPCIP)	0.585						
	Employees receive clearly stated organizational knowledge objectives (EmKObj)	0.692						
	Employees believe that top management emphasizes on knowledge sharing (EmKTopM)	0.541						
	Firm's KM systems improve access to external knowledge sources (BPKSrc)	0.735						
	Firm's KM systems improve the integration of critical information to process tasks (BPInfIntgr)	0.536						
3. KM Goals	Firm's KM goal is to improve knowledge retention (KFKReten)	0.633	0.608	0.590		0.649	0.83	0.73
	Firm's KM goal is to improve knowledge sharing (KFKShare)	0.855						
	Firm's KM goal is to improve communication (KFComm)	0.783						
	Firm's business processes are documented and kept up to date (BPDoc)	0.611						
	Firm uses standard measures for evaluating process (BPMetric)	0.537						
	Firm's use of process automation tools are consistent with the defined processes (BPAuto)	0.497						
4. Business Process Performance	Increase business process output (BPOutpt)	0.793	0.808	0.792	0.649		0.89	
	Improve overall business process performance (BPOverall)	0.825						
	Enhance the ability to meet process goals (BPGoal)	0.869						
	Improve business process output quality (BPQual)	0.842						
	Reduce business process cycle time (BPCycle)	0.718						
	Reduce business process variability (BPVarianc)	0.817						

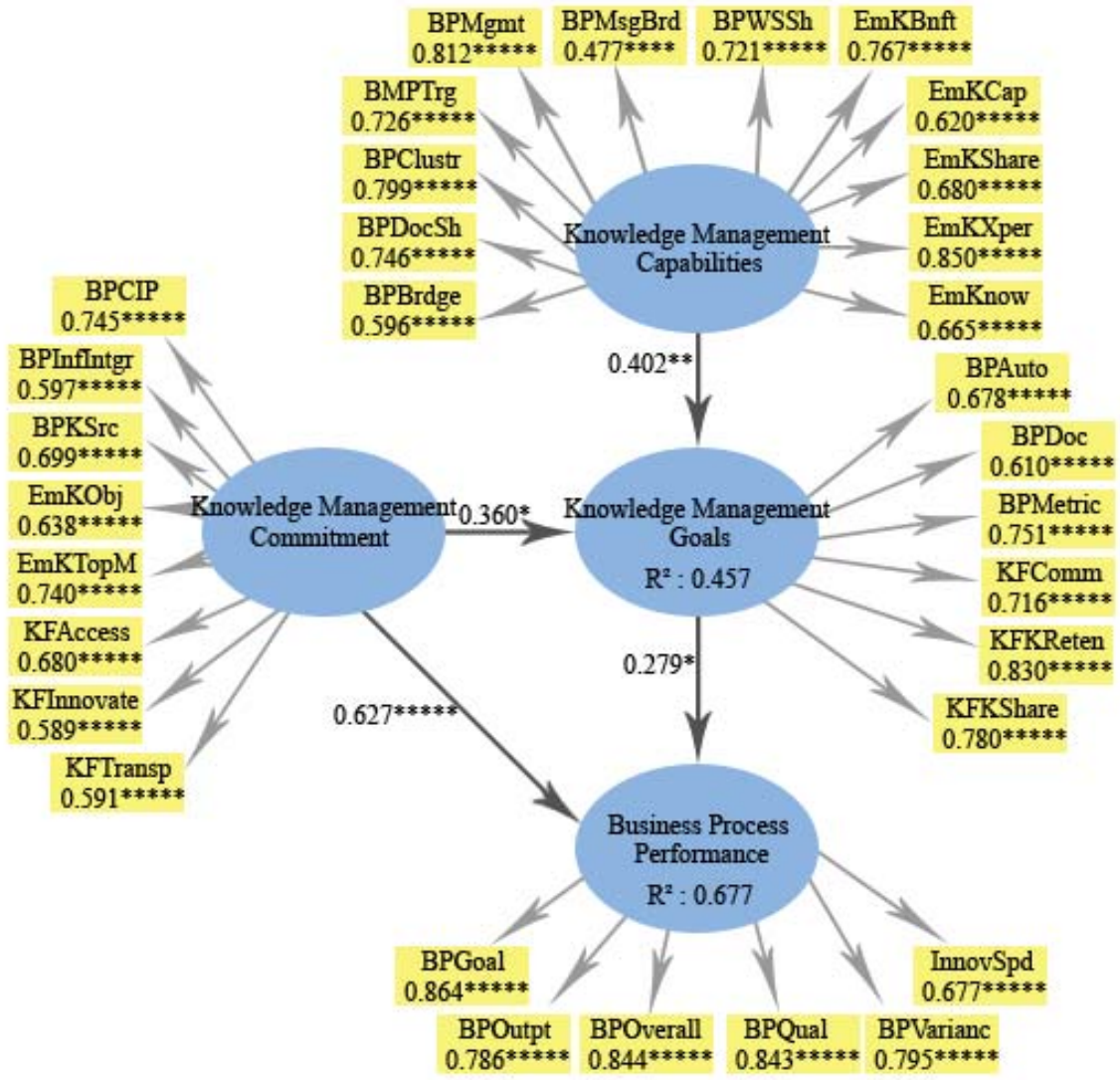

Figure 2: Measurement and Structural Model

***** p <= .0005; **** .0005 < p <= .005; *** .005 < p <= .05; ** < p < .025; * .025 < p <= .01

4. Bibliography

[1] Ahn, J.-H., & Chang, S.-G. 2004. Assessing the contribution of knowledge to business performance: the KP3 methodology. ***Decision Support Systems***, 36(4): 403-416.

[2] Anyanwu, K., Sheth, A., Cardoso, J., Miller, J., & Kochut, K. 2003. Healthcare Enterprise Process Development and Integration. ***Journal of Research and Practice in Information Technology***, 35(2): 83.

[3] Bose, R. 2003. Knowledge management-enabled health care management systems: capabilities, infrastructure, and

decision-support. ***Expert Systems with Applications***, 24(1): 59-71.

[4] Collins, H. M. 1996. Humans, Machines, and Structure of Knowledge. In R. L. I. Ruggles (Ed.), ***Knowledge Management Tools***: 145- 164: Butterworth-Heinemann.

[5] Chen, C.-P., Liu, P.-L., & Tsai, C.-H. 2008. A Study of the Influence of Organizational Knowledge Ability and Knowledge Absorptive Capacity on Organization Performance in Taiwan's Hi-Tech Enterprises. *Journal of Applied Sciences*, 8(7), 1138-1148.

[6] Day, G. 1994. The capabilities of market-driven organizations. ***Journal of Marketing***, 58(4): 37-52.

[7] Freeze, R., & Kulkarni, U. 2005. Knowledge Management Capability Assessment: Validating a Knowledge Assets Measurement Instrument. ***Paper presented at the 38th Hawaii International Conference on System Sciences***, Hawaii.

[8] Ghosh, B., & Scott, J. E. 2008. Knowledge Management for Healthcare Organizations: Comparing Strategies with Technical Support. ***Paper presented at the 41st Annual Hawaii International Conference on System Sciences***,.

[9] Ghoshal, S., & Gratton, L. 2002. Integrating the enterprise. ***MIT Sloan Management Review***, 44(1): 31.

[10] Goodhue, D., Lewis, W., & Thompson, R. 2006. PLS, Small Sample Size, and Statistical Power in MIS Research. ***Paper presented at the Proceedings of the 39th Hawaii International Conference on System Sciences***.

[11] Hoffman, J., Hoelscher, M., & Sherif, K. 2005. Social capital, knowledge management, and sustained superior performance. ***Journal of Knowledge Management***, 9(3): 93-100.

[12] Huang, C. C., & Huang, T. J. 2007. Knowledge Sharing and KM Effectiveness in Technology R&D Teams: Transactive Memory System and Team-based Oucome Expectations Perspectives. ***Paper presented at the IEEE***.

[13] Klein, H. J., Wesson, M. J., Hollenbeck, J. R., & Alge, B. J. 1999. Goal Commitment and the Goal-Setting Process: Conceptual Clarification and Empirical Synthesis. *Journal of Applied Psychology*, 84(6), 885-896.

[14] Koumpouros, Y., Nicolosi, G., & Martinez-Selles, M. 2006. Critical success factors for establishing a multidisciplinary health community knowledge management system using internet-based ICTs: the cardiology paradigm. ***International Journal of Healthcare Technology and Management***, 7(3): 283-302.

[15] Latham, G. P., & Locke, E. A. 2007. New Development in and Directions for Goal-Setting Research. *European Psychologist*, 12(4), 290-300.

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

[17] Lenz, R., & Reichert, M. 2007. IT support for healthcare processes - premises, challenges, perspectives. ***Data & Knowledge Engineering***, 61(1): 39-58.

[18] Locke, E. A., & Latham, G. P. 2002. Building a Practically Useful Theory of Goal Setting and Task Motivation: A 35-Year Odyssey. ***American Psychologist***, 57(9): 705-717.

[19] Maier, R., & Remus, U. 2003. Implementing process-oriented knowledge management strategies. ***Journal of Knowledge Management***, 7(4): 62-74.

[20] Meixell, M. J., Shaw, N. C., & Tuggle, F. D. 2008. A Methodology for Assessing the Value of Knowledge in a Service Parts Supply Chain. ***IEEE Transactions on Systems, Man, and Cybernetics, Part C: Applications and Reviews,***, 38(3): 446-460.

[21] Nicolini, D., Powell, J., Conville, P., & Martinez-Solano, L. 2007. Managing knowledge in the healthcare sector. A review. ***International Journal of Management Reviews***, 9(4): 1-19.

[22] Nonaka, I., & Takeuchi, H. 1995. ***The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation***. New York: Oxford University Press.

[23] Orzano, A. J., Claire R. McInerney, Davida Scharf, Alfred F. Tallia, & Benjamin F. Crabtree. 2008. A knowledge management model: Implications for enhancing quality in health care. ***Journal of the American Society for Information Science and Technology***, 59(3): 489-505.

[24] Prahalad, C. K. and Krishnan, M. S. 2008, ***The New Age of Innovation: Driving Co-Created Value Through Global Networks*** (McGraw Hill Books).

[25] Pub, B. 2005. *The Blackwell encyclopedia of management* (2nd ed.), Vol. 13, Blackwell Publishing Ltd.

[26] Quinn, J., & Anderson, P. Finklestein (1996)'Managing professional intellect: making the most of the best'. ***Harvard Business Review***, 74: 71–80.Ahn and Chang (2004)

[27] Ringle, Christian Marc/Wende, Sven/Will, Alexander, 2005 ***SmartPLS 2.0(Beta)***, http://www.smartpls.de

[28] Ronald Maier, U. R. 2002. Defining process-oriented knowledge management strategies. ***Knowledge and Process Management***, 9(2): 103-118.

[29] Savitz, L. A., Kaluzny, A. D., & Kelly, D. L. 2000. A life cycle model of continuous clinical process innovation. ***Journal of Healthcare Management***, 45(5): 307-315.

[30] Scally, G., & Donaldson, L. 1998. Looking forward: Clinical governance and the drive for quality improvement in the new NHS in England. ***BMJ: British Medical Journal***, 317(7150): 61.

[31] Stefanelli, M. 2004. Knowledge and process management in health care organizations. ***Methods Inf Med***, 43(5): 525-535.

[32] Tanriverdi, H., & Venkatraman, N. 2005. Knowledge relatedness and the performance of multibusiness firms. ***Strategic Management Journal***, 26(2): 97-119.

[33] Tuggle, F. D., & Goldfinger, W. E. 2004. A methodology for mining embedded knowledge from process maps. ***Human Systems Management***, 23(1): 1-13.

[34] Ulrich Remus, S. S. 2003. A blueprint for the implementation of process-oriented knowledge management. ***Knowledge and Process Management***, 10(4): 237-253.

[35] Van der Spek, R., & Spijkervet, A. 1997. Knowledge Management: Dealing Intelligently with Knowledge. In J. Liebowitz, & L. C. Wilcox (Eds.), ***Knowledge Management and Its Integrative Elements***: 31-60: CRC Press.

[36] Welt, D., & Jugendmedizin, K. 2004. Knowledge and Process Management in Health Care Organizations. ***Methods of Information in Medicine***, 43(5): 525-535.