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Examining Knowledge Management Enabled Performance for Hospital Professionals: A Dynamic Capability View and the Mediating Role of Process Capability

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Abstract

Healthcare organizations are essentially associated with highly knowledge-intensive property, and hospital professionals are key to providing high-quality care to patients. KM-enabled performance for hospital professionals is the major concern of senior management. The literature has generally argued for a process-based approach for KM-enabled performance in which process capabilities mediate the link between knowledge resources and performance. According to the knowledge-based view, KM-enabled performance should be rooted in the identification of knowledge resources, including knowledge assets and capabilities. Further, the concept of dynamic capabilities defines an interaction feature between knowledge assets and capabilities. Next, KM-enabled performance is generally defined to include both financial and patient performance. Based on the dynamic capability view and the mediating role of process capability, this research thus proposes a novel research model for exploring KM-enabled performance for hospital professionals, which this includes three major components: interaction between hospital knowledge assets and capabilities, hospital process capabilities, and hospital performance. The empirical results indicate that the model of KM-enabled performance is well fitted with these components, and hospital professionals are closely associated with KM-enabled performance in providing high-quality care.

Keywords: *Knowledge Management, Dynamic Capabilities, Process Capabilities, Patient Performance, Healthcare Sector.*

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Examining Knowledge Management Enabled Performance for Hospital Professionals: A Dynamic Capability View and the Mediating Role of Process Capability

1. Introduction

Today, healthcare providers face many challenges that include escalating costs and increased pressure to deliver high-quality care to patients (Chandra, Knickrehm, & Miller, 1995). Healthcare processes, including medical and administrative processes, are complex and dynamic in nature and critical to the effectiveness of healthcare providers (Anyanwu, Sheth, Cardoso, Miller, & Kochut, 2003; Stefanelli, 2004), Thus, healthcare organizations depend heavily on professional knowledge to effectively integrate and analyze clinics, prescriptions, billing, supply chains, and patient relationships, in and across organizational boundaries (Bose, 2003; Jadad, Haynes, Hunt, & Browman, 2000). Accordingly, healthcare organizations are essentially associated with knowledge-intensive property. In particular, medical personnel, including physicians and nurses, are key to the provision of care services to patients, and are acknowledged as real-knowledge workers.

Knowledge management (KM) is the process of creating value from knowledge resources in organizations. The KM field has wide applications and is valuable to healthcare organizations (Forgionne, Gangopadhyay, Klein & Eckhardt, 1999; Guptill, 2005). For example, the most notable application in hospitals is the use of evidence-based care-flow management systems (Stefanelli, 2004). While patient care relies on the vast amount of knowledge that is possessed by individual medical professionals, KM can effectively facilitate learning and the exchange of individual expertise and experience between professionals, and, in turn, result in an improvement in the quality of care and profitability (Abidi, 2001; Bose, 2003; Stefanelli, 2004). Therefore, larger investments in KM are necessary for hospitals to remain competitive, and the value justification for KM investments is often a major concern for management when KM initiatives are launched. However, empirical studies have demonstrated little or no improvement in organizational performance despite tremendous investments in KM (Kulkarni, Ravindran, & Freeze, 2007; Lee, Lee, & Kang, 2005; Shin, 2004). These studies are mostly based on the argument that there is a direct link between knowledge resources and organizational performance (Bogner & Bansal, 2007; Darroch, 2005; Haas & Hansen, 2005). Indeed, many researchers have argued a process-based concept for the proper evaluation of KM value in organizations. This process basically includes three steps: knowledge resources, business processes and organizational performance (Lee and Choi, 200; Ray et al., 2004; Stefaneli, 2004). Therefore, business processes play an important mediating role in creating organizational performance through the use of knowledge resources.

The resourced-based view (RBV) also asserts that firms can become more competitive by deploying valuable resources (Grover, Gokhale, & Narayanswamy, 2006; Pavlou, Housel, Rodgers & Jansen, 2005; Spender, 1996). KM-enabled performance should be rooted in the identification of knowledge resources, which includes knowledge assets and capabilities (Grant, 1996b; Gold, Malhotra, & Segars, 2001). Knowledge assets refer to valuable intellectual assets as inputs to an organization's value-creation process, which allow the organization to create and refresh its competencies, over time. Knowledge capability is an organization's ability to utilize knowledge assets to create, exploit, and renew knowledge synergy throughout a series of knowledge processes (Lee & Choi, 2003; Tanriverdi, 2005). In addition, research about the issue of organizational capability evolution suggests using a dynamic capability view for the concept of organizational capability (Helfat & Peterraf, 2003; Teece, Pisano, & Shuen, 1997; Zollo & Winter, 2002). In terms of KM, dynamic capability defines a transformation process with an initial configuration of knowledge assets as the input and a new configuration of knowledge capabilities as the output (Cepeda & Vera, 2007; Zahra, Sapienza, & Davidsson, 2006). Knowledge assets and capabilities may interact with each other to develop organizational capability and further improve organizational performance (Grant, 1996a; Spender, 1996).

Drawing from dynamic capability view and the mediating role of process capabilities, this research proposes a novel research model for the determination of KM-enabled performance for hospital professionals that comprises three major components: hospital knowledge resources, hospital process capabilities, and hospital performance. Specifically, dynamic capability defines an interaction between knowledge assets and capabilities. Because healthcare organizations represent a special

type of non-profit organization, this study simultaneously considers both the patient and financial performance in order to evaluate the overall performance. The balanced scorecard (BSC) ,which defines a relationship structure between the three major components, also provides the theoretical basis for this study (Voelker, Rakich, & Richard, 2001; Zelman, Pink, & Matthias, 2003). Little research has focused on the important role of hospital process capabilities in mediating the realization of KM-enabled hospital performance from knowledge sources. In addition, many researchers have argued that realized hospital performance may be affected by some hospital attributes factors other than KM-related attributes, such as reputation, size, or new equipment (Devaraj & Kohli, 2003; Langland-Orban, Gapenski, & Vogel, 1996; Shi, 1996). A hospital is generally classified as a certain type based on a combination of these attributes, so this study specifies the hospital type as a control variable for realized hospital performance.

2. Literature Review and Hypotheses Development

Using the above logic, Figure 1 provides a pictorial depiction of the research model. The following sections discuss the theoretical basis of this model, including the major constructs and subconstructs, and hypotheses development.

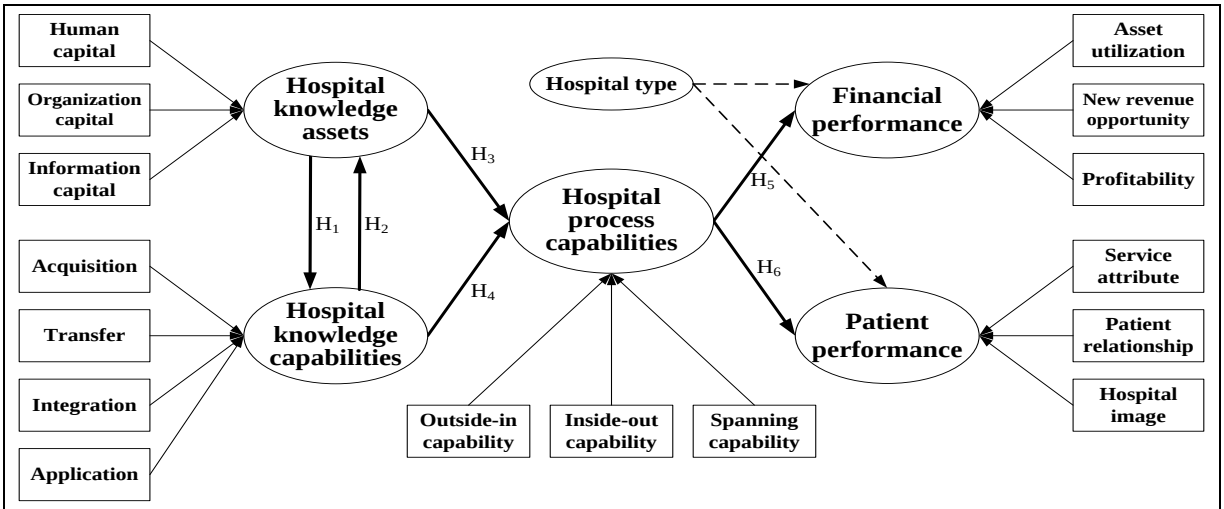

Figure 1. Research Model

2.1. Knowledge-Based View

Knowledge is usually defined as a set of rules or logical structures produced by human societies, in terms of a systematic mix of individual or organizational experience, skills, expertise, and know-how. In contrast, information is more generally defined as data processed into a form that has value to users when performing actions or making decisions (Li & Kettinger, 2006). Whie intangible in this sense, knowledge is an important resource for the maintenance of competitive performance in the RBV's perspective. We use the terms knowledge and knowledge resource interchangeably in this study. Specifically, many strategists believe that knowledge resources, rather than traditional physical resources such as land, equipment, and raw materials, are a business's primary capital and the most important input to an organization's value-creation process. The concept of knowledge resources mainly builds on an extension of the RBV (namely, the knowledge-based view), and has clear importance to the "knowledge economy" (Shin, 2004; Felin & Hesterly, 2007). Knowledge economy refers to using sophisticated knowledge in all fields of human-related activities wherein critical intellectual capital is strategically combined and integrated to improve an organization's effectiveness and efficiency (Alavi & Leidner, 2001).

As research on the knowledge-based view has progressed, it has become clear that this view is not only applicable to the assets of an organization, but also to its capabilities (Mahoney, 1995; Helfat & Peteraf, 2003). This use of knowledge resources in an organization's processes has spawned the rise of KM in which the capability of managing knowledge assets has become a core competence

of an organization to gain superior performance (Grant, 1996b; Cepeda & Vera, 2007). KM seeks to foster knowledge capabilities for the creation, conversion, application, and protection of the knowledge assets in organizations (Gold et al., 2001; Alavi & Leidner, 2001). This research thus broadly defines knowledge resources to include the assets and capabilities and their different roles in creating organizational value. Specifically, healthcare organizations utilize a huge amount of human capital with unique expertise and experience in the medical field, such as physicians, nurses and administrative staff, in order to provide high-quality care to patients. KM is an important mechanism that allows hospital professionals to gain new expertise and experience and to enhance their personal growth (Ghosh & Scott, 2005). In particular, physicians and nurses are the major knowledge workers in the hospitals.

2.2. Hospital Knowledge Assets and Capabilities

The term knowledge assets refers to valuable intangible assets gained through experience and learning that can be used in a series of value-creation processes to improve an organization's competencies (Marr & Moustaghfir, 2005). Knowledge assets are either the output of knowledge transformation processes or the accumulated stock of skills, expertise, and experience in an organization's workforce (Namasivayam & Denizci, 2006). They can form the basic competences of medical professionals that help them to understand current research developments, to produce medical advances, to reduce the number of medical errors, and to reduce costs in a more competitive healthcare market. While knowledge assets are widely embedded in an organization, knowledge assets can be classified in various ways (Chen et al., 2004; Lynn, 1998). Dawson (2000) defines knowledge assets to include three elements: human capital, structural capital, and relational capital. Kaplan and Norton (2004) classify intangible assets as having three basic components: human capital, organization capital, and information capital. Because organization capital involves both the external and internal attributes of an organization, it covers both structural capital (internal) and relational capital (external). In sum, the knowledge assets in this study include human capital, organization capital, and information capital.

Human capital in a hospital is defined in terms of hospital employees. Hospital employees are generally categorized as medical or non-medical personnel. The former are the primary operators in hospitals and include physicians and nurses who directly impact patient well-being. For physicians, human capital refers to individual clinical expertise, experience, and competence in the patient diagnosis, treatment, and prevention of disease as well as competence in collaborating with other medical staff to handle complex or emergency situations, such as the area of intensive care. For nurses, human capital refers to competence in communication with patients about their illness and better coordination with physicians in various treatment processes (operating room procedures in particular). Specifically, knowledgeable nurses often need to identify new symptoms, changes in conditions, and other critical factors during their interaction with inpatients. This capital is tacitly embedded in the minds of hospital employees and is not owned by the hospital (Hart, 2006; Kabene, Orchard, Howard, Soriano, & Leduc, 2006).

Organization capital in a hospital is defined as including all non-human storehouses of medical knowledge (Engstrom, Westnes, & Westnes, 2003), or, in other words, the knowledge that does not go home with hospital employees at night (Stewart, 1997). Specifically, hospital organization capital covers a wide scope of external and internal attributes. External attributes include knowledge of the healthcare market and the network of external stakeholders, such as patients, pharmaceutical suppliers, and insurance providers, who have an important influence on the hospital (Carson, Ranzijn, Winefield, & Marsden, 2004; Stefanelli, 2004). Internal attributes include knowledge of the hospital culture and norms, medical and administrative processes, organizational structures, and patents that can help to support hospital professionals in their quest for optimal intellectual performance (Gomes, 2007; Stefanelli, 2004). Finally, hospital information capital is an underlying element of knowledge assets and is defined as a general IS capability in this study. Hospital information capitalcan refer to the IT infrastructure and applications that support a hospital's strategies, medical and administrative processes, the clinical practices of medical professionals, and patient management processes (Ghosh & Scott, 2005). Examples include web-based infrastructure, hospital resource planning (HRP), supply chain management, and customer relationship management (CRM), which should all be well managed in order to enhance critical process capabilities for value creation (Kaplan & Norton, 2004).

Further, knowledge assets are conceptualized as a formative construct with the three capital indicators. This is explained in terms of the following four decision rules of Jarvis, MacKenzie, & Podsakoff (2003) and Petter, Straub, & Rai (2007). Firstly, the three indicators mainly define the construct of knowledge assets, rather than manifest it. Secondly, changes in the three indicators tend to cause changes in the knowledge assets. For reflective constructs, the change path is opposite. Thirdly, for reflective constructs, their indicators are required to covary with one another. However, the three indicators for knowledge assets may not have strong correlations with one another because they seem to indicate different issues. Finally, knowledge assets are clearly a composite of the three indicators that are very different in their definitions. Reflective indicators, however, correlate with one another and are interchangeable for sharing knowledge assets.

Knowledge capabilities refer to the abilities of an organization to utilize knowledge assets in a series of coordinated knowledge processes in order to produce knowledge synergy (Tanriverdi, 2005; Turner & Makhija, 2006). Knowledge capabilities is often used as a synonym for knowledge processes, which represent the basic operations for the input of knowledge assets (Lee & Choi, 2003; Tanriverdi, 2005). Previous studies have proposed various knowledge process models to identify different sets of knowledge functions. Examples include creation, storage, transfer, and application (Alavi & Leidner, 2001), acquisition, conversion, application, and protection (Gold et al., 2001), generation, codification, transfer, and realization (Grover & Davenport, 2001), creation, transfer, integration, and leverage (Tanriverdi, 2005), and acquisition, transfer, interpretation, and application (Turner & Makhija, 2006). In sum, knowledge acquisition broadly includes creation/generation, codification, and storage. Knowledge transfer is the same as conversion. Knowledge integration is similar to interpretation. Knowledge application is a synonym for realization and leverage, and is common to many knowledge process models. Accordingly, there are four major knowledge processes: acquisition, transfer, integration, and application.

Knowledge acquisition in a hospital involves knowledge creation on both an internal and external basis. Internally, physicians and nurses develop hospital knowledge through the processes of research, experimentation, and clinical experience (Kabene et al., 2006). The various types of hospital knowledge that medical personnel create are termed human capital. Hospital knowledge may also be acquired from external sources, such as the marketplace, competitors, pharmaceutical and medical equipment suppliers, insurance providers, and patients, through the processes of scanning and searching (Dawes & Sampson, 2003, Turner & Makhija, 2006). Once new knowledge is obtained, the codification process converts knowledge into accessible and applicable formats that can be further stored in the hospital's knowledge repository (Grover & Davenport, 2001).

Knowledge transfer in a hospital concerns the dissemination of knowledge in patient-specific treatment, physician-to-physician communication, and clinical courses for enhancing the physical and perceptual skills of physicians (e.g., executing a complex surgical intervention or interpreting a complex medical report (Bishop & Wing, 2005). Similar communications in the distribution of knowledge have also been identified for nurses, such as in dealing with issues surrounding the use of research findings in clinical practice (Ducharme, 1998; Lauder, Reynolds, & Angus, 1999; Aita, Richer, & Heon, 2007). Knowledge transfer is a cognitive process that involves cognitive resources and an inter-personal process, by which knowledge is transferred between individuals in hospitals (Aita et al., 2007). Knowledge transfer may be difficult in nature because valuable knowledge is embedded in individuals, contexts, or locations (Turner & Makhija, 2006). Thus, fostering a climate of knowledge sharing is important for knowledge transfer in hospitals.

Knowledge integration in a hospital concerns the processes that integrate transferred knowledge with the existing knowledge of the recipients (Patnayakuni, Ruppel, & Rai, 2006). Physicians can achieve this by an individual or a collaborative process (Rundall, Shortell, & Alexander, 2004). In an individual process, a physician can improve their own existing knowledge, including the diagnosis of disease and the interpretation of medical reports and prescriptions, by sharing and learning expertise-related knowledge from knowledge bases or peers in an effective manner. In a collaborative process, different physicians can work together using their knowledge from dealing with complex cases in terms of the diagnosis of disease, treatment methods or surgical operations, and post treatment to provide superior patient care (Faraj & Xiao, 2006). With the support of the Internet, this integration

can be both internal and external. Nurses also have many opportunities to interact with physicians and patients with both patients' physical ailments and psychological problems, in the provision of care services. This is particularly important while the patients stay in the hospital. Through these interactions, nurses can effectively integrate their own knowledge with new knowledge and thus become better knowledge workers (Patricia & Cynthia, 2002).

Knowledge application in a hospital involves the use of integrated knowledge to change the behavior of the recipients, such as an improvement in organizational learning and medical and administrative processes, and the further conversion of these integrated knowledge into improvements in actual hospital performance (Dawes & Sampson, 2003). Medical processes include the processes of diagnosis, treatment, prevention, prescription, and use of equipment, and administrative processes comprising the procedures of patient registration, admission, discharge, and resource allocation and training programs. Further, knowledge capabilities are defined as a formative construct using the four process indicators. The decision rules are similar to those previously mentioned. The four indicators are defined to explain knowledge capabilities. Any change in the four indicators, defined in a mutually exclusive manner, tends to cause changes in knowledge capabilities (Jarvis et al., 2003). Accordingly, knowledge capabilities can be viewed as a composite of the four indicators (Petter et al., 2007).

From the knowledge-based view, knowledge capabilities are defined as the use of knowledge assets, such as human, organization, and information capital, to produce knowledge synergy through a series of coordinated knowledge processes, such as knowledge acquisition, transfer, integration, and application. Specifically, Darroch (2005) indicates that intangible knowledge, such as human skills and experience, has an important link to knowledge acquisition and transfer. Lee and Choi (2003) note that organizational structure, culture, human skills, and information assets all play a critical role in determining knowledge acquisition and, further, lead to organizational creativity. Moreover, the dynamic knowledge-based view defines an important interaction between knowledge assets and capabilities for the improvement of an organization's operational capabilities, such as business or hospital process capabilities (Cepeda & Vera, 2007). Ghosh and Scott (2005), in particular, studied dynamic knowledge creation for the nursing function and found that it is an evolving process for the interplay between knowledge assets and capabilities. In this process, nurses are in a position to create new knowledge from their interactions with patients, and this new knowledge can be used to allow better communication with patients or with other nurses. Dawson (2000) argues that dynamic knowledge capabilities are part of an ongoing process wherein new knowledge is acquired from organizational members and integrated with existing knowledge for its further sharing and application in order to create value. Therefore, we hypothesize that:

H1: *Hospital knowledge assets positively affect knowledge capabilities.*
H2: *Hospital knowledge capabilities positively affect knowledge assets.*

2.3. Knowledge Resources and Hospital Process Capabilities

A business process is defined as the specific sequence of working activities for transforming a set of inputs into outputs (Gebauer & Schober, 2006). In the RBV, business processes provide a context in which to examine the locus of resource use (Barney, 1991). Business process capabilities describe an organization's ability to create value in a unique way by utilizing resources. Certain types of distinctive capabilities can be recognized in all organizations, which correspond to the core processes for creating economic value. Some scholars proposes a three-category typology to define business process capabilities; that is, "outside-in capability", "inside-out capability", and "spanning capability" (Day, 1994; Fahy & Hooley, 2002).

Outside-in capability refers to an organization's ability to sense the competitiveness of the external environment, to create long-term relationships with external stakeholders, and to rapidly respond to changes in the market (Fahy & Hooley, 2002). Therefore, outside-in capability tends to be externally focused and emphasizes an organization's ability to absorb and respond to external environmental changes (Wade & Hulland, 2004). In hospitals, key external processes include patient relationships, supplier partnerships (i.e., those with pharmaceutical and equipment suppliers), healthcare market monitoring, community relationships, the healthcare insurance policy, and the governmental healthcare policy. Inside-out capability refers to an organization's ability to improve the operations of

its internal processes (Banker, Bardhan, Chang, & Lin, 2006). It is often activated by market requirements, competition, and external opportunities. Therefore, inside-out capability is internal and focuses on the provision of better infrastructure and more effective operations that help organizations to develop differentiated value propositions and to maintain their competitive position (Kaplan & Norton, 2004; Wade & Hulland, 2004). In hospitals, important internal processes comprise medical services, administrative services, medical innovation, financial management, technology deployment, training, and career development programs.

Spanning capability refers to the ability of an organization to integrate outside-in and inside-out capabilities (Fahy & Hooley, 2002). Using internal and external analyses, spanning capability enables organizations to utilize valuable strengths, avoid potential weaknesses, explore market opportunities, and neutralize external threats. In hospitals, critical spanning hospital processes include the maintenance of market position, strategy development, inter- and intra-hospital collaboration, hospital-wide information integration, the delivery of new medical services, and the avoidance of medical errors (Banker et al., 2006; Wade & Hulland, 2004). Hospital process capabilities are further defined as a formative construct with the three capability indicators. The explanation is similar to those mentioned previously (Petter et al., 2007). It can be argued that distinctive process capabilities have different loci in an organization. They are defined as mutually exclusive variables in a combination to explain process capabilities. Changes in these variables tend to cause changes to process capabilities (Jarvis et al., 2003).

The literature indicates that KM plays a critical role in enabling business process redesign (Tseng, Grover, & Fiedler, 1994). Knowledge assets and capabilities are the most strategically important knowledge resources in an organization because they can be integrated to create business process capabilities and, in turn, improve performance (Grant, 1996b; Spender, 1996). Specifically, through organizational learning, knowledge assets are combined and embedded into business processes and thereby create or renew the core competences of the organization (Andreu & Ciborra, 1996). Thus, the development of process capabilities depends heavily on the mechanism whereby knowledge assets are integrated in organizations (Grant, 1996a). The integration of knowledge assets involves a series of process capabilities that take place in the organizational context and is also embedded in specific organizational routines (Nonaka, Toyama, & Konno, 2000). Moreover, while process capabilities are core initiatives used to implement business strategies, knowledge capabilities can enrich process capabilities in a way that integrates and utilizes tangible and intangible assets effectively and efficiently (Grant, 1996b; Darroch, 2005). In a hospital, process capabilities, including those for medical, patient, supplier, and innovation processes, describe a hospital's competence in terms of the professionals' ability to create market value and patient satisfaction in a way that uniquely utilizes knowledge resources. Both of the knowledge resources for hospital professionals (i.e., knowledge assets and capabilities) are the fundamental elements used to create hospital process capabilities. Therefore, we hypothesize that:

H3: *Hospital knowledge assets positively affect process capabilities.*
H4: *Hospital knowledge capabilities positively affect process capabilities.*

2.4. Hospital Process Capabilities and Hospital Performance

Healthcare organizations are a special type of non-profit organization (Magee, Davis, & Coulter, 2003). Healthcare organizations may involve many different stakeholders, such as patients and their families, employers, physicians, nurses, administrative staff, insurance companies, and the public. The main purpose of this sector is to provide patients with high-quality care. The performance measures are traditionally financial, such as ROI and sale revenue, and fail to fully reflect the effectiveness of a hospital. The BSC applied to hospitals suggests using both patient and financial measures in a complementary manner (Voelker et al., 2001; Zelman et al., 2003). A strategic map of the BSC defines three indicators for financial performance: asset utilization, new revenue opportunities, and profitability, and three indicators for patient performance: service attributes, patient relationships, and hospital image (Kaplan & Norton, 2004).

Asset utilization refers to the efficiency with which healthcare providers utilize medical facilities, patient beds, and hospital employees. New revenue opportunities refer to self-paying medical

services (those not paid for by the insurance company), new acquisition of patients, and better care in community services. Profitability is commonly recognized as evaluation indicators, such as ROI, profit margins, or revenue, and market share. Service attributes define the availability, accessibility, and quality of medical services. Patient relationships are defined in terms of satisfaction, partnership, and loyalty with patients. Hospital image represents the reputation, acceptance, and recognition of hospitals by their patients. These indicators demonstrate different aspects of financial and patient performance. Financial and patient performance can be formulated as a composite of the indicators for observing their variance. Accordingly, both performance constructs are defined as a formative construct using their indicators (Klein & Rai, 2009; Rai, Patnayakuni & Seth, 2006).

Most scholars acknowledge that organizational performance is more likely to be associated with capability-based advantage in a dynamically competitive environment (Grant, 1996a; 1996b; Grant & Baden-Fuller, 2004). From the RBV, business process capabilities are the most valuable and unique resources in enabling an organization to sustain its competitive advantage because they are protected by isolated mechanisms, such as social complexity, path-dependency, and unique historical conditions (Barney, 1991; Mata, Fuerst, & Barney, 1995). Many studies have found that core process capabilities, such as flexible management (spanning capability), customer relationship management (outside-in capability), and innovation management (inside-out capability), directly affect organizational performance (Barua, Kriebel, & Mukhopadhyay, 1995; Marr & Moustanghfir, 2005). In a hospital, this implies that core processes capabilities, such as inter- and intra-hospital collaboration, patient relationships, and medical innovation, tend to be unique and complicated in terms of exploiting valuable and rare knowledge resources. These process capabilities are most likely to be the major drivers of patient and financial performance in the hospitals (Ray, Barney, & Muhanna, 2004). Thus, we hypothesize that:

H5: *Hospital process capabilities positively affect financial performance.*
H6: *Hospital process capabilities positively affect patient performance.*

3. Research Design

We conducted a survey to collect empirical data. The instrument comprises a four-part questionnaire, which the Appendix shows. The first part uses a nominal scale and the others use a 7-point Likert scale.

3.1. Instrument

3.1.1. Basic Information

We collected information about organizational characteristics, which includes hospital type, annual revenue, and the number of employees, and the respondent's characteristics, which includes education, gender, age, work experience, and position.

3.1.2. Hospital Knowledge Resources

This part of the questionnaire includes hospital knowledge assets and capabilities. We define hospital knowledge assets using Chen, Zhu, and Xie's (2004) and Kaplan and Norton's (2004) definitions as adapted to the hospital domain, which includes three subconstructs: human, organization, and information capital. Organization capital contains four measurement items and each of the others includes three measurement items. Hospital knowledge capabilities are based on those stated by Alavi and Leidner (2001), Gold et al. (2001), Tanriverdi (2005), and Turner and Makhija (2006) as adapted to the hospital domain, which includes four subconstructs: knowledge acquisition, transfer, integration, and application. Each of these has three measurement items.

3.1.3. Hospital Process Capabilities

This part of the questionnaire includes three subconstructs: outside-in, inside-out, and spanning capability. They are based on a summary of the relevant literature and, further, are properly adapted to the hospital domain as discussed previously (Day, 1994; Fahy & Hooley, 2002; Wade & Hulland, 2004; Ray et al., 2004; Tallon, 2008). Each of these includes three measurement items. For example, the measurement items for outside-in capability include responding to changes in the healthcare market, creating durable partnerships with suppliers, and maintaining good interaction with patients.

3.1.4. Hospital Performance

Hospital performance includes patient and financial performance. These are initially defined based on the strategic map of the BSC in the business sector (Kaplan & Norton, 2004) and, further, are properly adapted to the hospital domain based on the literature pertaining to the BSC in the healthcare sector (Curtright, Stolp-Smith, & Edell, 2000; Voelker et al., 2001; Zelman et al., 2003). We define three subconstructs for financial performance: asset utilization, new revenue opportunities, and profitability. Each of these includes three measurement items. We also identify three subconstructs for patient performance: service attributes, patient relationships and hospital image. Each of these includes three measurement items.

3.1.5. Control Variable

As discussed previously, we consider three hospital types: medical center, regional hospital and district hospital.

3.2. Sample Design

This study chiefly examines KM-enabled hospital performance. The qualifying hospitals should have plentiful experience on massive KM investments for the management of medical and administrative services. Thus, we assumed that larger hospitals would be more likely to demonstrate this practice. Three types of hospital: medical center, regional hospitals, and district hospitals, are more appropriate for this study. We selected a study sample of 437 hospitals from the 2008 list of hospitals published by the Taiwan Joint Commission on Hospital Accreditation. This study focuses on understanding hospital performance. This is an enterprise-wide perspective and is often the major concern of senior management, so senior managers, including executives and vice executives, are the major subjects in this survey. The implementation of KM-based practice must take account of the role of IT in supporting this practice. According to the authors' understanding, IT managers are often most responsible for KM practice in the hospitals. They are also considered to be important subjects in this survey. In order to improve the survey return rate, we conducted a follow-up procedure that involved phone calls or letters to non-respondents two to three weeks after the survey.

3.3. Sample Demographics

Initially, we conducted a pretest for a scale. Selected relevant practioners and academicians carefullly examined the scale for translation, wording, structure, and content. We iteratively considered their comments when updating the scale in order to guarantee initial reliability and content validity. The initial reliability and content validity of the scale should be acceptable. Once the questionnaire had been finalized, we sent 437 questionnaires (one questionnaire per hospital) to sample subjects, executives, or IT managers by regular mail. One hundred and sixty questionnaires were returned, and after we deleted incomplete and invalid responses, there was a a sample size of 144 responses – an overall response rate of 32.9 percent. Table 1 depicts the sample demographics.

The seemingly low response rate raises concern about non-response bias. We tested the non-response bias for the response sample. By considering the late group of respondents as most likely to be similar to non-respondents, a comparison between the early and late group of respondents provides information on non-response bias in the sample (Armstrong & Overton, 1977; Subramani, 2004). Accordingly, we identified the early and late sub-samples as having 101 and 43 respondents, respectively. We used a t-test to ascertain whether there was any correlation between the two groups by examining various organizational characteristics, including hospital type, annual revenue, and the number of employees. All of the correlations revealed no significant difference at the 0.05 level (t values = 0.78, 0.38, and 0.59). The results indicate no systematic non-response bias for the survey data.

In addition, common method bias results from the fact that the respondents provide measures of the predictor and criterion variables using a common rater (Podsakoff et al., 2003). In this study,we used subjective measures for hospital knowledge assets and capabilities, hospital process capabilities, and financial and patient performance. There is a risk of common method bias. The Harman's single factor test is one of the most widely used techniques to address the issue of common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). We included all items from all of the constructs for a factor analysis to determine whether the majority of the variance is accounted for by

one general factor (more than 50% of the variance). The result shows five factors extracted from the empirical data. No single factor accounts for the bulk of the covariance. Therefore, we can conclude that there was no common method bias.

Table 1. Sample Demographics

		Frequency	Percent (%)
Hospital type	Medical center	6	4.2
	Regional hospital	76	52.8
	District hospital	62	43.0
Annual Revenue	<100 M	15	10.4
	100 M~500 M	53	36.8
	500M~1B	35	24.3
	1B~5B	28	19.4
	5 B~10B	13	9.1
Number of employees	< 200	16	11.1
	200~500	65	45.1
	500~1000	43	29.9
	1000~3000	17	11.8
	3000~5000	3	2.1
Work experience	< 5years	6	4.2
	5~10 years	46	31.9
	10~20 years	47	32.6
	20~30 years	40	27.8
	> 30 years	5	3.5
Education Level	High school	4	2.8
	College	92	63.9
	Graduate	43	29.9
	Ph. D.	5	3.5
Gender	Female	74	51.4
	Male	70	48.6
Age	<30	25	17.4
	30~40	79	54.9
	40~50	36	25.0
	50~60	4	2.8
Position	Executive/Vice	75	52.1
	IT Manager	50	34.8
	Senior staff	19	13.1

3.4. Scale Validation

PLS is a structural equation modeling technique that uses a non-parametric and component-based approach for estimation purposes. PLS is particularly suitable to formative structure and can accommodate a large number of indicators in the model because it allows latent variables to be modeled as formative constructs and places minimal demands on sample size and residual distributions (Chin, 1998; Chin, Marcolin, & Newsted, 2003). Theoretically, the sample size for PLS requires 10 times the number of indicators associated with the most complex construct or the largest number of antecedent constructs linked to an endogenous construct. We formulate the main variables in this study as a second-order measurement model with formative indicators. PLS is used to analyze this model for scale validation. Because PLS does not provide a significance test or interval estimation, we conducted a bootstrapping analysis using 1000 sub-samples, in order to estimate the path coefficients, the statistical significance, and the relevant parameters, including means, standard errors, item loadings, and item weights. We evaluted this model in two steps: the first step assessed reliability and convergent validity, and the second step examined discriminant validity.

Firstly, we assessed reliability for a value of Cronbach's α larger than 0.7 (Chin, 1998). We assessed convergent validity using three criteria: (1) the value for item loading (λ) and statistical significance, (2) the value for composite construct reliability, and (3) the value for average variance extracted (AVE) (Fornell & Larcker, 1981) These values needed to be 0.70 or higher, 0.80 or higher, and 0.50 or higher, respectively. We then assessed the discriminant validity between constructs using the criterion that the square root of AVE for each construct should be larger than its correlations with all other constructs (Fornell & Larcker, 1981). As Table 2 shows, the standardized item loadings range from 0.79 to 0.94, the composite construct reliabilities range from 0.80 to 0.94, and the average variances extracted (AVE) range from 0.70 to 0.87. The results indicate that all of the first-order subconstructs demonstrate high levels of reliability and convergent validity. In Table 3, the square root of the AVE for each subconstruct is larger than its correlations with all other subconstructs.Thus, all of the first-order subconstructs also meet the criteria for discriminant validity.

Table 2. Convergent Validity

Subconstruct	Items	Item loadings	Composite reliability	AVE	Cronbach's α
Human capital (HC)	3	.92 - .94	.94	.85	.90
Organization capital (OC)	4	.79 - .87	.82	.70	.80
Information capital (IC)	3	.90 - .93	.90	.79	.85
Knowledge acquisition (KA)	3	.89 - .92	.90	.85	.91
Knowledge transfer (KT)	3	.86 - .92	.91	.82	.85
Knowledge integration (KI)	3	.88 - .90	.89	.81	.84
Knowledge application (KA)	3	.91 - .96	.93	.85	.87
Outside-in capability (OI)	3	.82 - .89	.86	.77	.83
Inside-out capability (IO)	3	.85 - .90	.90	.76	.83
Spanning capability (SC)	3	.85 - .93	.91	.85	.96
Asset utilization (AU)	3	.90 - .93	.92	.84	.90
New revenue opportunity (NR)	3	.89 - .93	.92	.87	.92
Profitability (PR)	3	.92 - .94	.95	.86	.90
Healthcare service attribute (SA)	3	.90 - .93	.91	.83	.86
Customer relationship (CR)	3	.90 - .93	.94	.84	.86
Hospital image (HI)	3	.80 - .93	.88	.75	.81

Table 3. Discriminant Validity

Subconst.	HC	OC	IC	KA	KT	KI	KA	OI	IO	SC	AU	NR	PR	SA	CR	HI
HC	**.92**															
OC	.16	**.83**														
IC	.10	.23	**.89**													
KA	.18	-.05	.08	**.92**												
KT	.21	.15	.16	.23	**.90**											
KI	.24	.21	.24	.10	.16	**.90**										
KA	.17	.13	.20	.07	.25	.22	**.92**									
OI	.22	.24	.13	.15	.13	.15	.17	**.88**								
IO	.18	.09	.21	.14	.31	.26	.18	.23	**.87**							
SC	.15	.27	.14	.21	.12	.10	.10	.13	.08	**.92**						
AU	.08	.17	.20	.19	.07	-.05	.31	.26	.06	.15	**.91**					
NR	.16	.21	.21	.20	.13	.12	.21	.17	.13	.06	.21	**.93**				
PR	.21	.28	.17	.21	.08	.21	.16	.20	.20	-.07	.22	.11	**.93**			
SA	.08	.11	.18	.26	.10	.19	-.03	.19	.19	.18	-.08	.21	.11	**.91**		
CR	.30	.22	-.09	.15	.10	.22	.31	.10	.21	.21	.17	.08	.09	.12	**.91**	
HI	.16	.22	.10	.09	.14	.21	.09	.05	.13	.13	.08	.21	.16	.25	.12	**.87**

Diagonal value: Square root of AVE. Non-diagonal value: Correlation

4. Hypothesis Testing

We constructed a second-order structural model with formative indicators in order to examine the causal structure of this research model. We performed the evaluation in three steps (Chin, 1998). Firstly, we needed to estimate the standardized path coefficient and statistical significance for the influence paths. Next, we computed the coefficient of determination (R^2) for endogenous variables in order to assess their predictive power. The coefficient of determination, obtained from PLS analysis, is similar to that defined for multiple regression analysis. Finally, it is necessary to examine the relative importance of the first-order indicators in forming the second-order constructs. Indicator weights represent the relative importance of the indicators in forming the latent constructs (Chin, 1998). Figure 2 shows the results for the structural model.

Hospital knowledge assets positively affected knowledge capabilities (β = 0.52, standardized path coefficient) and explained 51 percent of the variance in knowledge capabilities. Thus, Hypothesis 1 is supported. As an argument for the dynamic capability aspect, hospital knowledge capabilities also played a determinant role in determining knowledge assets (β = 0.38) and explained 35 percent of the variance in knowledge assets. Thus, Hypothesis 2 is supported. Hospital knowledge assets showed a non-significant effect on process capabilities (β = 0.13). Thus, Hypothesis 3 is not supported. Hospital knowledge capabilities were a notable determinant of process capabilities (β = 0.47 at 0.01 level). Thus, Hypothesis 4 is supported. Hospital knowledge assets and knowledge capabilities jointly explained 48 percent of the variance in process capabilities. However, hospital knowledge capabilities were a more dominant precursor of process capabilities. This may indicate a mediating role for knowledge capabilities in terms of its effect on process capabilities from knowledge assets. This argument is confirmed by testing the original research model against a competing model with a deleted path from knowledge assets to process capabilities (Rai et al., 2006; Subramani, 2004). The difference between the R^2 values for the two models indicates the non-significance of the variable of process capabilities (R^2 = 0.47 vs. 0.46).

Hospital process capabilities were shown to be a prominent antecedent of both financial and customer performance (β=0.61 and 0.63). Hosptial process capabilities explained 41 and 48 percent of the variance in financial and patient performance, respectively. Thus, Hypotheses 5 and 6 are well

supported. While this model proposes that hospital process capabilities mediate the impact of knowledge assets and capabilities on financial and patient performance, it is necessary to test the effect of this mediation. We compared the original research model against a competing model with two extra direct paths from the two knowledge resource variables to each of the two performance variables (Baron & Kenny, 1986; Subramani, 2004). The results indicate that these path coefficients are all non-significant and that the difference between the R^2 values for the two models indicates the non-significance of each of the two performance variables.

In addition, we further examined the relative importance of the indicators in forming these latent variables. Human, organization, and information capital were three notable indicators in the formation of hospital knowledge assets (W = 0.90, 0.93, 0.70, Weight score), but human and organization capital were more important than the others. knowledge acquisition, transfer, integration, and application were all significant indicators in the formation of hospital knowledge capabilities (W = 0.71, 0.75, 0.90, 0.88), but knowledge integration and application were more important than the others. For hospital process capabilities, outside-in, inside-out, and spanning capabilities were all significant indicators in the formation of this structure (W = 0.90, 0.83, 0.68), but outside-in and inside-out capabilities were more important than the others. For financial performance, asset utilization and profitability were two critical indicators in the formation of this structure (W = 0.80, 0.92) and new revenue opportunity was less significant. For patient performance, healthcare service attribute, patient relationship, and hospital image were three prominent indicators in the formation of this structure (W = 0.87, 0.92, 0.69), but patient relationship was more important than the others. Finally, we found that the specified control variable hospital type was significantly associated with patient performance and not with financial performance.

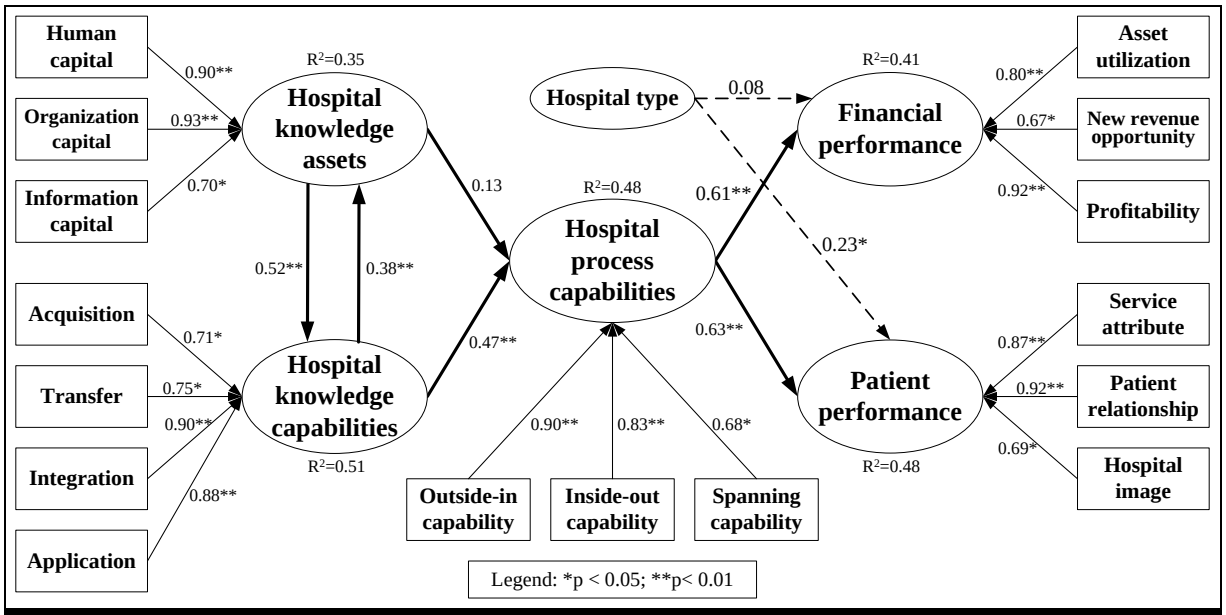

Figure 2. Results of Structural Model

5. Findings and Discussions

As Figure 2 indicates, the findings for the KM practice were twofold. The first concerns the findings for path relationships between the main variables. The second concerns the findings for the subconstructs (the first-order indicators) in the formation of the main variables.

5.1. Structural Analysis of the Main Variables

Taken as a whole, hospital knowledge resources, including assets and capabilities, played an underlying role in driving KM-enabled hospital performance through the mediator of process capabilities. Important findings include the interactive relationships between knowledge assets and capabilities, the mediating role of knowledge capabilities in enhancing process capabilities through

knowledge assets, and the mediating role of process capabilities in improving hospital performance through knowledge resources. In general, the empirical findings provide evidence that explains the two important issues: the dynamic knowledge-based view and the mediating role of process capabilities, which constitute the theoretical base for this research model. We discuss the two arguments below.

Firstly, hospital knowledge assets and knowledge capabilities showed an ongoing process of interaction with each other. They had high predictive power for each other (R^2 = 0.51 and 35). To explain this, we should consider that medical professionals use important expertise, skills, and experience to treat their patients effectively in the clinical conversion process. However, they also improve their own professional knowledge after learning from an effective or new treatment for the patients. This is an iterative process whereby medical professionals gain new knowledge, so it is particularly important to the management of hospitals. Moreover, hospital knowledge assets and knowledge capabilities both demonstrated high explanatory power for process capabilities (R^2 = 0.48), while knowledge capabilities played a more significant role in determining process capabilities (β = 0.47 vs. 0.13). In other words, the direct impact of knowledge assets on process capabilities is non-significant, although knowledge capabilities have positive impact on knowledge assets, from the dynamic capability perspective. The impact of knowledge assets on process capabilities mainly occurred through the mediator of knowledge capabilities (β = 0.62).

To explain this, consider again that hospital knowledge assets are primarily viewed as the raw inputs for a series of knowledge processes that produce knowledge synergies. Specifically, hospital knowledge assets are the expertise, experience, and competence of the hospital professionals who use these assets to create new medical service processes (a type of process capability) through individual efforts in the diagnosis and treatment of patients and the prevention of disease (a type of knowledge capability), and through collaborative efforts with other professionals in handling complex medical procedures Therefore, knowledge assets indirectly affect the new process capabilities through the mediator of knowledge capabilities. In other words, knowledge capabilities, rather than knowledge assets, are the major drivers for the redesign of various hospital processes in an iterative manner, such as medical and administrative processes. This procedure is clearly demonstrated in the knowledge-based view in terms of its applications in the healthcare sector.

Hospital process capabilities had high predictive power for both financial (R^2 = 0.41) and patient performance (R^2 = 0.48). As previously discussed, hospital process capabilities is an important mediator in improving both financial and patient performance. The reason behind this is explained below. In fact, no hospital resource can operate independently, and hospital resources must be associated with process capabilities in order to ensure their effective utilization in creating hospital value. Moreover, the creation of process capabilities is necessarily associated with intangible resources/knowledge that support learning and growth capabilities, such as norms and culture, professional expertise, and management procedures. These process capabilities are usually in a form that is difficult to copy to finally produce superior hospital performance (Andreu & Ciborra, 1996; Barney, 1991). There are many internal and external critical process capabilities that determine the success of a hospital, such as medical services, administration services, patient services, medical innovation, and logistical services with pharmaceutical and equipment suppliers. As discussed previously, these can be categorized as outside-in, inside-out, or spanning capabilities.

In general, we can classify hospital processes into two major types based on the property of process activities: the operational and management processes (Tseng et al., 1994). The redesign of operational processes mainly focuses on reducing the degree of the mediating dimensions, while management processes focus on enhancing the degree of the collaborative dimensions. Specifically, the major operation-based processes in hospitals are more technical in nature; examples include supplier relationships, logistics, community services (a similarity to outside-in processes), andequipment allocation, bed utilization, and human development (a similarity to inside-out processes). The redesign of these operational processes with the support of knowledge resources can efficiently reduce the degree of their mediating dimensions. This results in an improvement in various financial criteria, which includes asset utilization efficiency, rapid response to market change, new revenue opportunities, healthcare market share, and profit margins, as indicated in the attributes

of financial performance. Next, the major management-based processes in hospitals are more complex in nature; examples include medical services, medical innovation, patient service, and managerial decision-making. The redesign of these management processes with the support of knowledge resources can effectively enhance the degree of the collaborative dimensions. As defined in the attributes of patient performance, this results in an improvement in the quality of medical services, patient satisfaction and hospital image.

Finally, a few words about the control variable are in order. The three hospital types: medical center, regional hospital, and district hospital, showed no significant difference in impacting financial performance ($\beta = 0.08$). Under the new health insurance policy in Taiwan, the government agency is the only provider of healthcare resources. Since a limited insurance resource intends to support the entire program, the medical payments for all hospitals have been significantly reduced. Accordingly, most hospitals have recently invested many resources in KM in order to improve their medical and administrative service processes by reducing their cost structure. However, there was a significant difference among the three hospital types in terms of their effect on patient performance ($\beta = 0.23$). The use of KM to increase patient-related performance may be at a very early stage in Taiwan. Larger hospitals, such as medical centers, are currently in a better position than regional hospitals or district hospitals to invest heavily in KM to improve patient performance.

5.2. Components of the Main Variables

Human and organization capital were more important elements in the formation of knowledge assets than information capital. From the knowledge-based view, knowledge assets are unique and valuable to the hospital and theses elements intends to explain the important attributes. Human and organization capital are usually presented in a form that involves personal values, social complexity, and unique historical conditions, which this study clearly confirms. Knowledge integration and application were more important indicators in the formation of knowledge capabilities than knowledge acquisition and transfer. However, previous research has placed more emphasis on knowledge transfer or sharing (Bock, Zmud, Kim, & Lee, 2005; Slaughter & Kirsch, 2006). This is an important finding for more properly defining knowledge resources. It can be explained in terms of the achievement of final knowledge performance. While knowledge transfer an important element of knowledge management in the creation of knowledge performance, it may be an intermediate transformational step in the value creation process. The same logic can be also applied to the phenomenon of knowledge acquisition. In contrast, knowledge integration and application are more likely to be closely connected to the final creation of new care services in a hospital (Stefaneli, 2004; Song, van der Bij & Weggeman, 2005).

Outside-in capability was a more important indicator in forming hospital process capabilities than inside-out and spanning capability. This investigation was mainly conducted in the healthcare sector, so stakeholder satisfaction, such as patient satisfaction, is a more important concern for this sector than cost-related performance. Outside-in capability is more externally focused on responding to changes in the healthcare market and further, on creating long-term relationships with external stakeholders or patients. Inside-out and spanning capability are more internally focused on improving individual medical expertise, skills, and the efficiency of the administrative and medical processes. They partially involve the issue of hospital policies or strategies and have less effect on external stakeholders.

Profitability was the major indicator in forming financial performance, and new revenue opportunities were less significant. The health insurance program in Taiwan is a type of social health insurance system that pools the risk for every citizen. The government agency is the only provider of healthcare insurance resources and regulates the fees for all care/treatment items. There are quite a few new revenue opportunities for hospitals in this particular healthcare market. Therefore, this element may not be properly reflected in financial performance. Financial performance, such as sales revenue, return on investment, and profitability, has been historically considered to be the ultimate measure in the business sector. Although hospitals can be considered to be a special type of public non-profit organization that focuses on achieving patient-related performance targets, they cannot maintain regular operations without financial support for their various expenditures. Therefore, profitability-related measures are also major indicators of financial performance in the healthcare sector.

Finally, healthcare service attributes and patient relationships are more important in explaining patient performance than hospital image. Healthcare service attributes are more internally focused on improving medical services for the patients. In contrast, patient relationships place external emphasis on improving the mutual trust between a hospital and its patients and on patient satisfaction. More importantly, a high quality of care services may further lay the foundation for building long-term relationships with patients. This study fully confirms the significant effect of both components.

6. Conclusion

In general, the empirical data supported the overall theoretical model with respect to the three main variables. This finding provides useful guidance for KM practice in hospitals in terms of a new management approach for the dynamic knowledge-based view and the mediating role of process capabilities.

The research's implications for healthcare practioners is as follows. Because knowledge assets and capabilities are the basic elements for realized financial and patient performance, these must be carefully nurtured for an extended period of time before they can fully affect hospital performance. Medical professionals must also appreciate the importance of the interaction between knowledge assets and capabilities in an evolutional process in order to improve their expertise knowledge. Process capabilities are strengthened by improving professionals' knowledge resources. This implies that professionals' learning and growth plays an important intermediate role in effectively building process capabilities. This concept is relatively important for KM practices in hospitals, where professionals are highly recognized as knowledge workers for effectively raising the quality of care. Considering this, KM-enabled performance may be more fully achieved for massive KM investments. There is also a time-lag effect in achieving KM-enabled performance that should be considered for the decisions of KM investments. Finally, both financial and patient performance are significantly and similarly improved in the KM-enabled value creation process. This provides insight to design a more effective performance evaluation system for hospital personnel and resource management.

The research's implications for researchers are as follows. Firstly, many studies on KM-enabled performance have involved the business sector, but few have investigated the healthcare sector. Secondly, prior research has only concerned a partial set of knowledge resources, such as knowledge assets, which have a direct or indirect effect on organizational performance through a knowledge-creation process. However, the importance of process capabilities as a mediator in effectively achieving organizational performance has been neglected. This study considers these concepts in a complete manner. Moreover, this study defines two performance measures: financial and patient, for hospital organizations. This avoids mixed/inconsistent findings for KM-enabled performance, as is often the case for prior research. In brief, this study proposes a new theoretical logic to better understand KM-enabled performance for hospital professionals. Thirdly, while the survey concentrates on larger hospitals, which Table 1 indicates, this increases the generalizability of the results to other types of hospitals. Finally, we used a second-order formative structure with PLS analysis to further analyze the relative importance of indicators in the formation of the main constructs. This provides important information for effectively constructing the main constructs and further performing a more valid analysis.

Subsequent research could use this study as a foundation. We empirically examined this research frameworkusing a large sample survey. Future research might involve the use of a longitudinal case study to understand the effect of this research model in depth. This study mainly focuses on one of the knowledge-intensive sectors, the healthcare sector. Future research might target other important knowledge-intensive industries, such as the banking and insurance industry, in order to understand their differences and similarities in different aspects. Finally, although this research has produced useful results, a number of limitations may exist. While the main respondents were originally intended to be executives or IT managers in hospitals, approximately 13.1% of the respondents were senior staff. This may be because senior managers in larger hospitals are often busy and had their surrogates complete the questionnaires. Although this sample might more or less represent different experiences of KM practice, it also increases the diversity of data sources from multiple informants and therefore increases the explanatory variance in the variables of interest. The health insurance program in Taiwan is a type of social health insurance system that pools the risk for all citizens. The

generalizability of the results may have certain limitations if applied to other countries. In addition, it is quite difficult to make a survey of senior executives in hospitals. We tried many different channels, such as hospital employees, friends, and part-time students working for hospitals, to ensure that the questionnaires were completed.

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References

Aita, M., Richer, M-C., & Heron, M. (2007). Illuminating the processes of knowledge transfer in nursing. *Worldviews on Evidence-Based Nursing*, *4*(3), 146-155.

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, *25*(1), 107-133.

Andreu, R., Ciborra, C. (1996). Organizational learning and core capabilities development: The role of IT. *Journal of Strategic Information Systems*, *5*(2), 111-127.

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), 83-98.

Abidi, S. S. (2001). Knowledge management in healthcare: Towards "knowledge-driven" decision support services. *International Journal of Medical Informatics*, *63*, 5-18.

Armstrong, J., & Overton, T. (1977). Estimating non-response bias in mail survey. *Journal of Marketing Research*, *14*(3), 396-402.

Banker, R. D., Bardhan, I. R., Chang, H., Lin, S. (2006). Plant information systems, manufacturing capabilities, and plant performance. *MIS Quarterly*, *30*(2), 315-337.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99-120.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182.

Barua, A., Kriebel, C. H., & Mukhopadhyay, T. (1995). Information systems and business value: An analytic and empirical investigation. *Information Systems Research*, *6*(1), 3-23.

Bishop, P. B., & Wing, P. C. (2005). Knowledge transfer in family physicians managing patients with acute low back pain: A prospective randomized control trial. *The Spine Journal*, *6*, 282-288.

Bock, G. W., Zmud, R. W., Kim, Y. G., & Lee, J. N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly*, *29*(1), 87-111.

Bogner, W. C., & Bansal, P. (2007). Knowledge management as the basis of sustained high performance. *Journal of Management Studies*, *44*(1), 165-188.

Bose, R. (2003). Knowledge management-enabled health care management systems: Capabilities, infrastructure, and decision-support. *Expert Systems with Applications*, *24*, 59-71.

Carson, E., Ranzijn, R., Winefield, A., & Marsden, H. (2004). Intellectual capital: Mapping employee and work group attributes. *Journal of Intellectual Capital*, *5*(3), 443-463.

Cepeda, G., & Vera, D. (2007). Dynamic capabilities and operational capabilities: A knowledge management perspective. *Journal of Business Research*, *60*(5), 426-437.

Chandra, R., Knickrehm, M., & Miller, A. (1995). Healthcare's IT mistake. *The McKinsey Quarterly*, *3*, 90-100.

Chen, J., Zhu, Z., & Xie, H. Y. (2004). Measuring intellectual capital: A new model and empirical study. *Journal of Intellectual Capital*, *5*(1), 195-212.

Chin, W. W. (1998). Issues and opinion on structural equation modeling. *MIS Quarterly*, *22*(1), 7-16.

Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information Systems Research*, *14*(2), 189-217.

Curtright, J. W., Stolp-Smith, S. C., & Edell, E. S. (2000). Strategic performance management: Development of a performance measurement system at the Mayo clinic. *Journal of Healthcare Management*, *45*(1), 58-68.

Dawes, M., & Sampson, U. (2003). Knowledge management in clinical practice: A systematic review of information seeking behavior in physicians. *International Journal of Medical Informatics*, *71*(1), 9-15.

Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of Knowledge Management*, *9*(3), 101-115.

Dawson, R. (2000). Knowledge capabilities as the focus of organizational development and strategy. *Journal of Knowledge Management*, *4*(4), 320-327.

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

Devaraj, S., & Kohli, R. (2003). Performance impacts of information technology: Is actual usage the missing link? *Management Science, 49*(3), 273-289.

Ducharme, E. (1998). For a rapid knowledge transfer in healthcare setting. *L'infirmi`ere du Qu´ebec*, *5*(5), 41-48.

Engstrom, T. E., Westnes, P., & Westnes, S. (2003). Evaluating intellectual capital in the hotel industry. *Journal of Intellectual Capital, 4*(3), 287-303.

Fahy, J., & Hooley, G. (2002). Sustainable competitive advantage in electronic business: Towards a contingency perspective on the resource-based view. *Journal of Strategic Marketing*, *10*(4), 241-253.

Faraj, S., & Xiao, Y. (2006). Coordination in fast-response organizations. *Management Science*, *52*(8), 1155-1169.

Felin, T., & Hesterly, W. S. (2007). The knowledge-based view, nested heterogeneity, and new value creation: Philosophical considerations on the locus of knowledge. *Academy Management Review*, *32*(1), 195-218.

Forgionne, G. A., Gangopadhyay, A., Klein, J. A., & Eckhardt, R. (1999). Electronic commerce as an enabler of efficient healthcare decision-making. *Electronic Markets*, *9*(1), 1–5.

Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research*, *18*(3), 382-388.

Gebauer, J., & Schober, F. (2006). Information system flexibility and the cost efficiency of business processes. *Journal of the Association for Information Systems, 7*(3), 122-147.

Ghosh, B., & Scott, J. E. (2005). Comparing knowledge management in healthcare and technical support organizations. *IEEE Transactions on Information Technology in Biomedicine*, *9*(2), 62-168.

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems*, *18*(1), 185-214.

Gomes, O. (2007). Investment in organizational capital. *Managerial and Decision Economics*, *28*(2), 107-113.

Grant, R. M. (1996a). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, *17*(7), 109-122.

Grant, R. M. (1996b). Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. *Organizational Science*, *20*(4), 375-387.

Grant, R. M., & Baden-Fuller, C. (2004). A knowledge accessing theory of strategic alliances. J*ournal of Management Studies, 41*(1), 61-84.

Grover, V., & Davenport, T. H. (2001). General perspective on knowledge management: Fostering a research agenda. *Journal of Management Information Systems*, *18*(1), 5-21.

Grover, V., Gokhale, R. A., & Narayanswamy, R. S. (2006). Resource-based framework for IS research: Knowledge firms and sustainability in knowledge markets. *Journal of the Association for Information Systems, 10*(4), 306-332.

Guptill, J. (2005). Knowledge management in health care. *Journal of Health Care Finance*, *31*(3),10-14.

Hart, K. A. (2006). Human capital management: Implications for health care leaders. *Nursing Economics*, *24*(4), 218-222.

Haas, M. R., & Hansen, M. T. (2005). When using knowledge can hurt performance: An empirical test of competitive bidding in a management consulting company. *Strategic Management Journal*, *26*, 1-24.

Helfat, C. E., & Peteraf, M. A. (2003). The dynamic resource-based view: Capability lifecycles. *Strategic Management Journal*, *24*(10), 997-1010.

Jadad, A. R., Haynes, R. B., Hunt, D., & Browman, G. P. (2000). The Internet and evidence-based decision-making: A needed synergy for efficient knowledge management in health care. *Canada Medical Association Journal, 162*(3), 362-365.

Jarvis, C. B., MacKenzie, S. B., & Podsakoff, P. M. (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research*, *30*(2), 199-218.

Kabene, S. M., Orchard, C., Howard, J. M., Soriano, M. A., & Leduc, R. (2006). The importance of human resource management in health care: A global context. *Human Resource for Health*, *20*(4), 20-37.

Kaplan, R. S., & Norton, D. P. (2004). Measuring the strategic readiness of intangible Assets. *Harvard Business Review*, *82*(2), 52-63.

Klein, R., & Rai, A. (2009). Inter-firm strategic information flows in logistics supply chain relationships. *MIS Quarterly*, *33*(5), 735-762.

Kulkarni, U. R., Ravindran, S., & Freeze, R. (2007). A knowledge management success model: Theoretical development and empirical validation. *Journal of Management Information Systems*, *23*(3), 309-347.

Lauder, W., Reynolds, W., & Angus, N. (1999). Transfer of knowledge and skills: Some implications for nursing and nurse education. *Nurse Education Today*, *19*(6), 480-487.

Langland-Orban, B., Gapenski, L. C., & Vogel, W. B. (1996). Differences in characteristics of hospitals with sustained high and sustained low profitability. *Hospital Health Services Administration*, *41*(3), 385-399.

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.

Lee, K. C., Lee, S., & Kang, I. W. (2005). KMPI: Measuring knowledge management performance. *Information & Management, 42*(3), 469-482.

Li, Y., & Kettinger, W. (2006). An evolutionary information-processing theory of knowledge creation. *Journal of the Association for Information Systems*, *7*(9), 593-617.

Lynn B. E. (1998). Performance evaluation in the new economy: Bringing the measurement and evaluation of intellectual capital into the management planning and control system. *International Journal of Technology Management*, *16*(1), 162-176.

Magee, H., Davis, L. -J., & Coulter, A. (2003). Public views on healthcare performance indicators and patient choice. *Journal of Royal Society of Medicine*, *96*(7), 338-342.

Mahoney, J. (1995). The management of resources and the resources of management. *Journal of Business Research*, *33*(2), 91-101.

Marr, B., & Moustanghfir, K. (2005). Defining intellectual capital: A three-dimension approach. *Management Decision, 43*(9), 1114-1128.

Mata, F. J., Fuerst, W. L., & Barney, J. B. (1995). Information technology and sustained competitive advantage: A resource-based analysis. *MIS Quarterly*, *19*(4), 487-505.

Namasivayam, K., & Denizci, B. (2006). Human capital in service organizations: Identifying value drivers. *Journal of Intellectual Capital*, *7*(3), 381-393.

Nonaka, I., Toyama, R., & Konno, N. (2000). SECI, Ba and leadership: A unified model of dynamic knowledge creation. *Long Range Planning*, *33*(1), 5-34.

Patnayakuni, R., Ruppel, C. P., & Rai, A. (2006). Managing the complementarity of knowledge integration and process formalization for systems development performance. *Journal of the Association for Information Systems*, *7*(8), 545-567.

Patricia, M., & Cynthia, A. (2002). Nurse practitioner knowledge of complementary alternative health care; foundation for practice. *Journal of Advanced Nursing*, *39*(1), 9-16.

Pavlou, P. A., Housel, T. J., Rodgers, W., & Jansen, E. (2005). Measuring the return on information technology: A knowledge-based approach for revenue allocation at the process and firm level. *Journal of the Association for Information Systems*, *6*(7), 199-226.

Petter, S., Straub, D., & Rai, A. (2007). Specifying formative constructs in information systems research. *MIS Quarterly*, *31*(4), 623-656.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. -Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879-903.

Rai, A., Patnayakuni, R., & Seth, N. (2006). Firm performance impacts of digitally-enabled supply chain integration capabilities. *MIS Quarterly*, *30*(2), 225-246.

Ray, G., Barney, J. B., & Muhanna, W. A. (2004). Capabilities, business, processes, and competitive advantage: Choosing the dependent variable in empirical tests of the resource-based view. *Strategic Management Journal, 25*(1), 23-37.

Rundall, T. G., Shortell, S. M., & Alexander, J. A. (2004). A theory of physician-hospital integration: Contending institutional and market logics in health care field. *Journal of Health and Social Behavior*, *45*,102-117.

Shi, L. (1996). Patient and hospital characteristics associated with average length of stay. *Health Care Management Review*, *21*(2), 46-61.

Shin, M. (2004). A framework for evaluating economics of knowledge management systems. *Information & Management, 42*(1), 179-196.
Slaughter, S. A., & Kirsch, L. J. (2006). The effectiveness of knowledge transfer portfolios in software process improvement: A field study. *Information Systems Research*, *17*(3), 301-320.
Song, M., van der Bij, H., & Weggeman, M. (2005). Determinants of the level of knowledge application: A knowledge-based and information-processing perspective. *Journal of Product Innovation Management*, *22*(5), 430-444.
Spender, J. C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, *17*, 45-62.
Stefaneli, M. (2004). Knowledge and process management in health care organizations. *Methods of Information in Medicine*, *43*(5), 525-535.
Stewart, T. A. (1997). *Intellectual capital: The new wealth of organizations*. New York: Doubleday / Currency.
Subramani, M. R. (2004). How do suppliers benefit from information technology use in supply chain relationships? *MIS Quarterly*, *28*(1), 45-73.
Tallon, P. P. (2008). Inside the adaptive enterprise: An information technology capabilities perspective on business process agility. *Information Technology and Management*, *9*(1), 21-36.
Tanriverdi, H. (2005). Information technology relatedness, knowledge management capability, and performance of multibusiness firms. *MIS Quarterly*, *29*(2), 311-334.
Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509-533.
Tseng, J. T. C., Grover, V., & Fiedler, K. D. (1994). Business process reengineering: Charting a strategic path for the information age. *California Management Review*, *36*(3), 9-31.
Turner, K. L., & Makhija, M. V. (2006). The role of organizational controls in managing knowledge. *Academy Management Review, 31*(1), 197-217.
Voelker, K. E., Rakich, J. S., & Richard, F. G. (2001). The balanced scorecard in healthcare organizations: A performance measurement and strategic planning methodology. *Hospital Topics*, *79*(3), 13-24.
Wade, M., & Hulland, J. (2004). The resource-based view and information systems research: Review, extension, and suggestions for future research. *MIS Quarterly*, *28*(1), 107-142.
Zahra, S., Sapienza, H. J., & Davidsson, P. (2006). Entrepreneurship and dynamic capabilities: A review, model, and research agenda. *Journal of Management Studies*, *43*(4), 917-955.
Zelman, W. N., Pink, G. H., & Matthias, C. B. (2003). Use of the balanced scorecard in healthcare. *Journal of Healthcare Finance, 29*(4), 1-66.
Zollo, M., & Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science, 13*(3), 339-351.

Appendix: Questionnaire

Table 4. Questionnaire

Part 1	**Basic information**
	(1) Hospital type (2) Annual revenue (NT$ millions) (3) Number of employees (persons) (4) Work experience (years) (5) Education level (6) Gender (7) Age (8) Position
Part 2	**Knowledge resource** (On a scale of 1 (strongly disagree) to 7 (strongly agree), indicate the level of the following scale items)
	Knowledge assets
	Human capital (1) My hospital is excellent in terms of the medical and administrative personnel's skill. (2) My hospital is excellent in terms of the medical and administrative personnel's talent. (3) My hospital is excellent in terms of the medical and administrative personnel's know-how. **Organization capital** (4) My hospital possesses precise knowledge of the healthcare market. (5) My hospital possesses precise knowledge of competitor orientation. (6) My hospital has a supportive culture that allows medical and administrative personnel to try things. (7) My hospital has efficient medical and administrative processes for patient care. **Information capital** (8) My hospital has superior IT infrastructure to support hospital's strategies. (9) My hospital has superior IT applications to support clinical and administrative processes. (10) My hospital has superior IT capability to support patient management processes.
	Knowledge capabilities
	Acquisition (1) My hospital has the ability to develop the knowledge of medical and administrative personnel. (2) My hospital has the ability to codify acquired knowledge into applicable formats. (3) My hospital has the ability to store acquired knowledge in the hospital repository. **Transfer** (4) My hospital has the ability to transfer relevant knowledge to medical and administrative personnel. (5) My hospital has the ability to distribute relevant knowledge throughout the hospital. (6) My hospital has the ability to share relevant knowledge between medical and administrative units. **Integration** (7) My hospital has the ability to organize relevant medical and administrative knowledge. (8) My hospital has the ability to integrate different medical and administrative knowledge. (9) My hospital has the ability to interpret new knowledge on the basis of prior knowledge. **Application** (10) My hospital has the ability to apply knowledge to develop new medical services. (11) My hospital has the ability to apply knowledge to change healthcare market competition. (12) My hospital has the ability to apply knowledge to maintain patient relationships.

Table 4. Questionnaire

Part 3	**Hospital process capabilities** (On a scale of 1 (strongly disagree) to 7 (strongly agree), indicate the level of the following scale items)
	Outside-in (1) My hospital has the ability to respond to changes in the healthcare market quickly. (2) My hospital has the ability to create long-term partnership with relevant suppliers. (3) My hospital has the ability to maintain good interaction and communication with patients. **Inside-out** (4) My hospital has the ability to improve medical and administrative services. (5) My hospital has the ability to improve medical service innovation. (6) My hospital has the ability to improve new medical technology deployment. **Spanning** (7) My hospital has the ability to execute intra- and inter-hospital collaboration between stakeholders. (8) My hospital has the ability to execute medical and administrative information integration. (9) My hospital has the ability to execute new medical service delivery and to avoid medical errors.
Part 4	**Hospital performance** (On a scale of 1 (strongly disagree) to 7 (strongly agree), indicate the level of the following scale items)
	Financial performance
	Asset utilization (1) My hospital can increase its utilization of medical facilities through the aid of KM practice. (2) My hospital can increase the turnover of beds through the aid of KM practice. (3) My hospital can increase the efficiency of human resources through the aid of KM practice. **New revenue opportunity** (4) My hospital can increase revenue from self-payment medical services through the aid of KM practice. (5) My hospital can increase revenue from the new patient market through the aid of KM practice. (6) My hospital can increase revenue from better community services through the aid of KM practice. **Profitability** (7) My hospital can increase return on investment through the aid of KM practice. (8) My hospital can increase profit margins through the aid of KM practice. (9) My hospital can increase healthcare market share through the aid of KM practice.
	Patient performance
	Service attribute (1) My hospital can increase the availability of medical services through the aid of KM practice. (2) My hospital can increase the accessibility of medical services through the aid of KM practice. (3) My hospital can increase the quality of medical services through the aid of KM practice. **Patient relationship** (4) My hospital can increase patient satisfaction through the aid of KM practice. (5) My hospital can increase partnership with patients through the aid of KM practice. (6) My hospital can increase patient loyalty through the aid of KM practice. **Hospital image** (7) My hospital can increase hospital reputation in the market through the aid of KM practice. (8) My hospital can increase hospital recognition in the market through the aid of KM practice. (9) My hospital can increase hospital ranking in the market through the aid of KM practice.

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