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Using ICT to enhance Knowledge Management in higher education: A conceptual framework and research agenda

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ABSTRACT

The adoption and use of ICT to enhance and facilitate Knowledge Management (KM) has brought to focus the urgent need to come out with new methods, tools and techniques in the development of KM systems frameworks, knowledge processes and knowledge technologies to promote effective management of knowledge for improved service deliveries in higher education. To succeed in KM, higher education institutions must endeavor to effectively link KM initiatives and processes with their ever-changing needs to advance their goals. Addressing these challenges call for a new conceptual framework and expanded research agenda to ensure success in the utilization of ICT in KM. Using the synergies from Stankosky's (2005) KM pillar for enterprise learning together with the task/technology fit theory (Goodhue and Thompson, 1995) to form the basis for defining our approach, this paper proposes a conceptual framework for using ICT to enhance KM in higher education. In addition, the paper identifies several research issues to bridge the gap that currently exists between the requirements of theory building and testing to address the different emerging challenges in using ICT to enhance KM in higher education.

Keywords: *knowledge management, ICT, higher education, conceptual framework, research agenda*

INTRODUCTION

KM is a discipline that is concerned with the analysis and technical support of practices used in an organization to identify, create, represent, distribute and enable the adoption and leveraging of good practices embedded in collaborative settings and, in particular, in organizational knowledge processes. Effective KM is an increasingly important source of competitive advantage, and a key to the success of contemporary organizations, bolstering the collective expertise of its employees and partners. The application and use of ICT to support KM in higher education is currently an emerging challenge and requires a new conceptual approach and research agenda to address new challenges. ICT uses in KM provide us with the potential for greatly enhanced access to knowledge combined with the challenge of how to manage the access (Hawkins, 2000). In addition, it promises improvements in the quality, efficiency, and effectiveness of higher education process; and draws solutions from and contributes to multiple disciplines including management, information retrieval, artificial intelligence, and organizational behavior.

Different perspectives from different areas contribute to the consolidation of the KM approaches and research issues. However, while the KM infrastructure through use of ICT has advanced tremendously in recent times with the development of social computing tools and models, we still need to rethink of new conceptual framework, research agenda, strategies and models that are more adaptive and responsive to emerging KM challenges, focusing less on formal structure and hierarchies. Many of our traditional business models, public organizational structures and higher educational systems are yet to integrate new

forms of KM within and outside organizational boundaries. The globally expanding and highly competitive knowledge-based economy requires organizations to urgently seek new insights into KM approaches and research agenda to help in nurturing, harvesting and managing the immense potential of available knowledge assets for capability to excel at the leading edge of innovation.

To be able to effectively manage their knowledge resources, higher education institutions need to have appropriate KM framework in place. KM framework refers to integration of organizational knowledge in organizational culture, organizational information technology infrastructure and the organization's store of individual and collective experiences, learning, insights, and values (Allee, 1997). Members can effectively accomplish higher education goals through use of effective KM processes and procedures (von Krogh et al., 2001). A firm that effectively manages knowledge is likely to be considered a learning organization (Mellander, 2001). A sound KM conceptual framework methodology helps to fulfill the goals of achieving competitive advantage by providing important guiding principles and directions on KM. According to Baskerville and Dulipovici (2006), understanding how pre-existing theories have been used to build a developing field such as KM is important because these theories substantiate and legitimize the field. Together with methods and aims, theories are a key part of any field's claims to scientific rationality. To effectively manage knowledge using ICT in higher education, we need to understand the choices that should be considered to develop an effective KM framework using ICT.

The prominence and importance of KM has been increasingly recognized in the academic and business arena. As such, many researchers and practitioners have developed various frameworks and other relevant approaches to help the emergence of KM into practice. However, most of the existing frameworks appear to have been derived from the experiences and considerations of business organizations, rather than of higher education institutions. In addition, existing methods do not adequately address all of the requirements for effective KM (Rubenstein-Montano et al. 2001). There is lack of a universally accepted methodology for KM as well as of a universal set of terms, vocabulary, concepts and standards in the KM community. In this context, the need for a new conceptual framework and research agenda in using ICT to enhance KM in higher education has never been more urgent. The fact that KM has become a key theme in major academic conferences worldwide reflects the urgent need for a structured approach and research in this rapidly emerging field.

Based on review and synthesis of relevant literatures, this paper proposes a conceptual framework for using ICT to enhance KM in higher education and identifies a research agenda to bridge the requirements of theory building and testing to address the different emerging challenges. First, a review of the theoretical background related to using ICT to enhance KM in higher education is given. This includes using three theoretical stances to make our case, namely: KM theory, adoption and diffusion of technology theory, and learning organization theory. To substantiate the background theories and support further the development of the framework, Stankosky's (2005) KM pillar to enterprise learning (2005) together with the task/technology fit theory (Goodhue and Thompson, 1995) will be incorporated in the approach and used to develop the conceptual framework by properly situating enabling ICT in higher education process, KM processes and KM outcomes (higher educational goals). Finally, identification of some of the key research issues to address the different emerging challenges and a concluding remark will be made. It is hoped that the development of the conceptual framework and identification of new research agenda can contribute to understanding the theories and practices of KM, and guide ongoing/future research in the same field as part of a broader strategy to address emerging challenges.

THEORETICAL CONCEPTS

KM

The objectives of KM in organizations are to promote knowledge growth, knowledge communication and knowledge preservation (Steels, 1993) and entails managing knowledge resources in order to facilitate access and reuse of knowledge (O'Leary, 1998a). As a key progress factors in higher education, KM aims at capturing explicit and tacit knowledge in order to facilitate the access, sharing, and reuse of that knowledge as well as create new knowledge and facilitate organizational learning. To succeed, KM must be guided by a strategic vision to fulfill primary organizational objectives such as improving knowledge sharing and cooperative work, disseminating best practices, improving relationships with the external world, and preserving past knowledge for reuse.

Nonaka et al. (2000) have developed the Socialization, Externalization, Combination and Internalization (SECI) model, which describes four main knowledge conversion modes: from tacit to tacit, tacit to explicit, explicit to explicit and explicit to tacit. The SECI model provides a concrete development scheme and describes both the processes of knowledge creation and sharing, and transformations taking place within and between individuals, groups and organizations, which are all interconnected. *Socialization* presents a process of tacit knowledge sharing between individuals working in the same environment and understanding it. *Externalization* is the process of transforming tacit knowledge into forms (symbols, analogies and metaphors), which can be understood by other group members. As a result, individual's tacit knowledge become a group's asset. Then, through *combination,* knowledge is organized, edited and systemized; it is shared with other groups and finally becomes a "common property" in the organization. When it is put into practice and used by employees, it is embedded in individuals' skills and competencies, which may lead to a generation of new tacit knowledge. Nonaka et al. called this last stage *internalization* (Nonaka et al. 2000).

Choenni et al. (2005) approaches the subject of KM from two perspectives: a cognitive approach and a community approach. According to the cognitive model, knowledge is captured, analyzed, developed, created, organized and shared by individuals with the use of ICT. In the community approach on the other hand, social interaction, communication and collaboration are in the center of KM. Thus, knowledge is the result of actions of different communities performing in the same or similar contexts. For this reason, it is highly related to a concrete context and situation, and therefore dynamic and changeable by nature.

Hansen, et al. (1999) divides approaches to KM into two categories: the codification approach and the personalization approach. The codification/people-to-document approach is centered on the computer. Organizations use ICT to capture, store, disseminate, and allow for the re-use of knowledge. This approach allows many people to search for and retrieve codified knowledge without having to contact the person who originally developed it. This approach therefore allows for knowledge to be accessed and used easily by anyone in the organization. The personalization/people-to-people approach on the other hand is centered on the dialogue between individuals, not the knowledge objects in a database. In this approach, knowledge is closely tied to the person who developed it and is mutually shared, mainly through direct person-to-person contact. The main purpose of ICT in this approach is mainly to help in communication of knowledge, and not necessarily to store it.

Organizational Learning

In his proposition of a knowledge-based view of firm, Grant (1996) points out that competitive success is governed by the capability of organizations to develop new knowledge-based assets that create core competencies. Although these knowledge-based assets exist in many

forms, the author argues that organizational learning is an integral part of any learning organization that effectively utilizes its knowledge resources to generate superior performances. Indeed, successful learning organizations create an organizational environment that combines organizational learning with KM (Pemberton and Stonehouse, 2000). According to Easterby-Smith and Lynes (2003), organizational learning should be understood to be as either a technical or a social process. The *technical* view assumes that organizational learning is about the effective processing, interpretation of, and response to, information both inside and outside the organization. This information may be quantitative or qualitative, but is generally explicit and in the public domain. The *social perspective* on organizational learning on the other hand focuses on the way people make sense of their experiences at work. These experiences may derive from explicit sources such as financial information, or they may be derived from tacit sources, such as the 'feel' that skilled craftsperson has, or the intuition possessed by a skilled strategist. From this view, learning is something that can emerge from social interactions, normally in the natural work setting. In the case of explicit information it involves a joint process of making sense of data.

Argyris and Schon (1978) identify three types of organizational learning namely single-loop, double-loop and triple-loop learning. Single-loop learning takes place when an organization is responding to changes in the environment without changing the core set of its organizational norms and practices and involves detection and correction of errors. Essentially, an individual or organization notices a discrepancy between performance and desired goals and take corrective action. Double-loop learning on the other hand entails responding to changes in the environment by changing the core set of organizational norms and assumptions (Bierly et al. 2000). It involves questioning of underlying assumptions and goals leading to changes in informal and formal routines and processes, and sometimes yielding radical change in organizational design. However, single-loop and double-loop learning is no longer sufficient for organizations that currently operate in an increasingly hypercompetitive and volatile environments. To address this, organizations need to engage in triple-loop learning – continuously challenging their mission, vision, strategies and culture and constantly questioning existing products, processes, structures and systems in view of future market place (Wang and Ahmed, 2003). Such organizations should operate continuous learning cycles - where knowledge is constantly being acquired, created, shared and implemented (Sambrook and Stewart, 2000).

Numerous studies have noted the relationship between KM and organizational learning. Lopez et al. (2004) see KM as a process that facilitates knowledge sharing and exchange and establishes learning as a continuous process within the organization. McElroy (2000) points out that second generation KM - that form which promotes education and innovation – is emerging as a kind of implementation strategy for organizational learning. The author sees a three-way convergence of KM, organizational learning and complexity theory, with the latter giving the needed picture of how knowledge evolves naturally. Rowley (2001) puts KM processes within a cycle which together form the organization's learning process. In terms of models or frameworks, Firestone and McElroy (2004) define organizational learning as the organizational processes through which individuals, groups, teams and the organization learn, and this is addressed at various places in their conceptual framework. At the level of decisions and actions which integrate into operational, knowledge, and KM processes; agent engage in single-loop learning through what is known as the decision execution cycle (planning, acting, monitoring, and evaluating behaviors). This involves monitoring the changing specific conditions about the agent's situation and self, and subsequently acquiring knowledge about those changes using pre-existing knowledge and capabilities. Finally, the cognitive model of KM dealing with socialization, externalization, combination and internalization is linked with Kim's (1993) integrated model of organizational learning. Kim (1993) claims that making mental model explicit is crucial to developing new, shared mental models, which is where most of the organization's knowledge resides.

Adoption and Diffusion of ICT

Although theories and models that are associated with the adoption and diffusion of ICT innovations in business organizations have been developed and there may be some variations in the principles involved as far as the education sector is concerned, the main underlying principles of understanding early adopter characteristics and motives for embracing innovations; understanding innovation's characteristics, its benefits, costs, and associated learning curves; and understanding factors in relation to the institution, its culture and services (institutional framework for change adoption), are applicable across all sectors. According to Pedersen (2003), studies on ICT adoption have generally taken three possible approaches: a diffusion approach, an adoption approach and a domestication approach.

The Diffusion Approach: Rogers Diffusion of Innovation theory (2003) argues that media and interpersonal contacts provide information that influences a person's opinion and judgement. The theory incorporates three components, namely the innovation-decision process, innovation characteristics, and adopter characteristics. The innovation-decision process categorizes the steps an individual takes from awareness of innovation, through the formulation of an attitude to the innovation, on to the decision as to whether to implement, and finally confirmation of this approach, i.e, knowledge, persuasion, decision, implementation and confirmation. The characteristics of innovation which may include compatibility, complexity, observability, relative advantage and attempts have an impact on the likelihood of acceptance and adoption, and also on the rate at which innovation process develops. Finally, Rogers (2003) defines the socio-economic characteristics of early adopters under the broad categories of socio-economic characteristic, personality values characteristic, and communication behavior characteristic. According to the theory, the degree of interpersonal influence an early adopter possesses within the innovation decision-process will affect the dissemination of the innovation to others.

***The Adoption Approach*:** The theories that are commonly used to enumerate adoption approach include the Technology Acceptance model, the Theory of Reasoned Action, and the Theory of Planned Behavior (Pedersen, 2003). The Technology Acceptance Model suggests that when a user is presented with a new technology, a number of factors influence their decision regarding how and when they will use it. This includes its perceived usefulness, ease of use, external variables and intention/attitudes of users as shown in figure 2 (Cloete and Courtney, 2002). However, other factors such as personal control, economic factors, outside influences from suppliers, customers and competitors are not considered by the Technology Acceptance Model (van Akkeren and Cavaye, 1999). To overcome the limitation of the Technology Acceptance Model, the Theory of Reasoned Action was introduced and is a more general theory than the Technology Acceptance Model and includes four general concepts namely: behavioral attitudes; subjective norms; intention to use; and actual use. The Theory of Planned Behavior on the other hand is an extension of the Theory of Reasoned Action and deals with conditions where the individual has no control of their behavior.

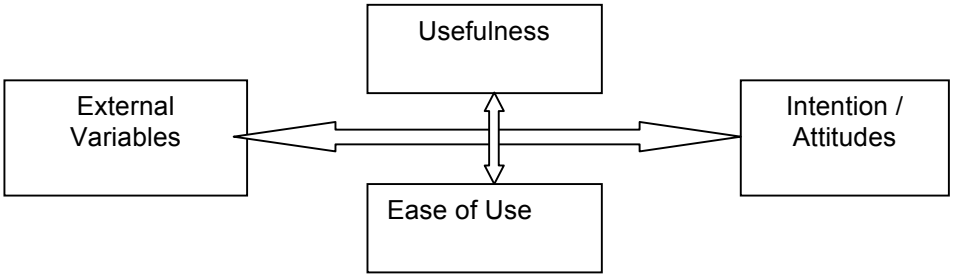

Figure 1: *Technology Acceptance Model (Cloete and Courtney, 2002)*

***The Domestication Approach*:** This approach focuses on the process in which technology becomes an integral part of everyday habits and conceptual context distinctions are applied to new phenomena. Three important distinctions include work and leisure context; end-users that belong or do not belong to a demographic group; and the private and public context.

PERSPECTIVES ON KM

Effective KM is an increasingly important source of competitive advantage, and a key to the success of contemporary organizations, bolstering the collective expertise of its employees and partners. There are several perspectives on KM, but all share the same core components, namely: People, Processes and Technology. Some take a techno-centric focus, in order to enhance knowledge integration and creation; some take an organizational focus, in order to optimize organization design and workflows; some take an ecological focus, where the important aspects are related to people interaction, knowledge and environmental factors as a complex adaptive system similar to a natural ecosystem. Essentially, the different perspectives look at methods to manage human interactions better and aim to leverage organizational knowledge and to support the process of managing them (Hansen et al., 1999; Mentzas et al., 2001).

Wiig (1993) considers KM in organizations from three perspectives: business perspective, management perspective, and hands-on perspectives; with each perspective having different horizon and purposes. The business perspective focus on why, where and to what extent the organization must invest in or exploit knowledge, and looks at strategies, products and services, alliance, acquisitions or divestments from knowledge-related point of view. The management perspective focuses on determining, organizing, directing, facilitating, and monitoring knowledge-related practices and activities required to achieve the desired business strategies and objectives. The hands-on perspective on the other hand focuses on applying the expertise to conduct explicit knowledge-related tasks.

Alavi and Leidner (1999) conducted a study to ascertain the meaning that managers ascribed to the concept of KM and came out with three perspectives: an information-based perspective, a technology-based perspective, and a culture-based perspective. In the information-based perspective, KM is viewed as a means for tracking who holds knowledge and how to locate them, rather than a system for keeping track of the knowledge itself. KM systems capability here is identified to include external knowledge such as knowledge about clients, competitors, and customers, as well as internal knowledge such as financial, human resource, and product/service knowledge. In the technology perspective, KM is associated with existing technology that comprised their organizational technology infrastructure such as data warehouses, intranets, and the World Wide Web as well as existing tools including search engines, multi-media and decision-supporting tools. In the culture-based perspective, organizational learning, communication, intellectual property cultivation were identified as constituting the elements of KM. They attributed cultural and managerial issues as accounting for the bulk of KM issues, but were not specific about the cultural implication of KM.

Tsoukas (1996) typology divides KM studies in two approaches (the taxonomic approach and the brain metaphor). In the taxonomic approach, knowledge is, or can be reduced to a portable object that can be created, stored and distributed. In the brain metaphor, knowledge is essentially distributed within a social group, residing not only in each individual, but also in the connections between them. The same discussion can be found in Schultze and Stabell's (2004) duality - dualism dimension: In duality, knowledge can be fully converted to a portable object, while in dualism that transformation cannot be done, and thus relationships do play an important role in knowledge sharing.

PROPOSED CONCEPTUAL FRAMEWORK

A conceptual framework defines a structure within the design that is developed and gives a general presentation based on previously established observations stemming from the reviewed literature. Currently, available evidence from literature indicates that several perspectives describe a KM framework development approach and some of these dimensions to KM practice capture the current application of ICT in enhancing KM and may serve as a guide for identifying approaches for the development of a framework for using ICT in enhancing KM in higher education. Sprague (1980) points out that the development of information systems should be informed by a well designed framework that integrates business processes and the needed information technology with the associated function to facilitate the KM framework development (Alavi and Leidner, 2001). The emphasis here is on the need for understanding the organizational knowledge generating activities that are being supported by ICT in a knowledge-led environment.

Using Stankosky's (2005) KM pillar to enterprise learning together with the task-technology fit theory (Goodhue and Thompson, 1995) to form the basis for defining our approach, this paper proposes a conceptual framework that links higher education processes involved in generating knowledge to enabling ICT and KM processes to arrive at a systematic and holistic framework for improved KM outcomes to achieve higher education goals. Stankosky's (2005) KM pillars to enterprise learning consist of leadership, organization, technology and learning in support of enterprise-wide KM initiatives and each of these pillars represent critical success factors for KM implementation. The task/technology fit theory on the other hand holds that the use of information technology is more likely to have a positive impact on individual performance and should be used if the capabilities of the information technology match the tasks that the user must perform (Goodhue and Thompson, 1995). In the proposed framework, organization and leadership are subsumed to form a constituent part of the higher education process, enabling ICT, and KM processes which form the three key elements of the framework while the resulting output is represented by the KM outcomes. Figure 2 shows the diagrammatic representation of the proposed conceptual framework. The following sections give an explanation of the roles and contributions of each of the element in the development of the proposed conceptual framework.

Higher Education Processes/Knowledge Generating Activities

Higher Education Processes/Knowledge Generating Activities constitute the first element of the framework and consist of a set of logically interconnected knowledge-generating activities through which actors convert inputs into outputs to achieve higher education goals. The process may be viewed as a time-ordered sequence of interrelated activities that describe the entire experience of an entity as it flows through a system (Sepehri et al. 2004). These processes usually cut across functional or organizational boundaries and the outputs are passed on to knowledge users who can be within or outside an organization. The traditional approaches to providing higher education are facing challenges to fit the current knowledge economy, resulting in turn into a financial and structural crisis. This is particularly true with respect to e-learning and other ICT-based knowledge delivery services. E-learning refers to the use of Internet technologies to create and deliver a rich learning environment that includes a broad array of instruction and information resources and solutions with the goal of enhancing individual and organizational performance (Rosenberg, 2006). Succeeding in e-learning and the use of ICT-based knowledge delivery services will require creating an environment and culture where new ways to learn are encouraged, embraced, and accepted at all levels through change management. This is where the roles of leadership become critical.

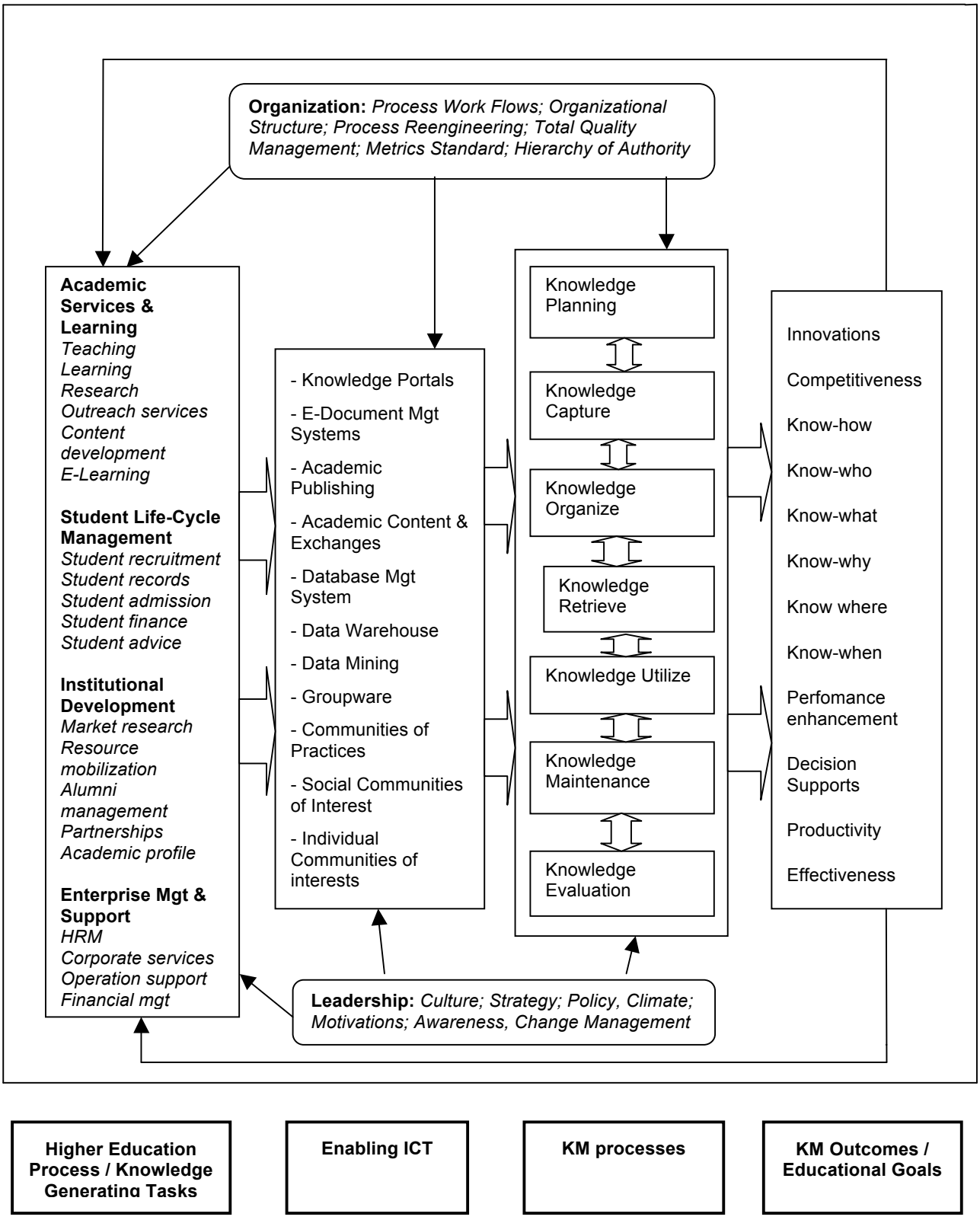

Figure 2: *Proposed Conceptual Framework for KM in Higher Education*

To achieve success, higher education process must be refined with respect to new methods and existing technologies to provide knowledge development and transfer for delivering academic services and learning, student life-cycle management, institutional development, and enterprise management and support, in more productive ways (Systems Analysis and Programme Development, 2005). Delivering *Academic Services and Learning* includes teaching, learning, research, content development, e-learning and outreach services; *Student Life-cycle Management* includes managing student recruitment, student admission, student records, student finances, and academic advises; *Institutional Development* includes market research and analysis, resource mobilization, alumni management, partnerships, and academic profile; while *Enterprise Management and Support* includes human capital management, corporate services, operation support, and finance.

KM Enabling ICT

ICT enables and provides the entire infrastructure and tools to support KM processes within an enterprise (Hendriks, 2001). To succeed in KM, it is important that assessment and defining of ICT capabilities are done properly as it supports and facilitates KM processes such as knowledge capture, storage, retrieval, sharing and collaboration, dissemination, and updates in organizations in higher education. In this paper, several KM enabling ICT tools and networks were identified to be relevant for developing the proposed framework due to their significance in carrying out KM roles. These include *Knowledge Portals, Electronic Document Management Systems, Academic Publishing, Academic Contents and Exchanges, Database Management Systems (DBMS), Data Warehouse, Data Mining, Groupware, Communities of Practices (CoP), Social Communities of Interests,* and *Individual Communities of Interests.* Table 1 below gives a description of the roles of each of the identified KM enabling ICT tools/networks with examples in the proposed conceptual framework.

Table 1: *KM Enabling ICT Tools/Networks*

ICT Tools/Networks	Description of Roles	Examples
Knowledge Portals	Search and access to web-based knowledge	Google, Yahoo,
E-Document Management Systems	Knowledge repositories created by individual academic institutions	Digital Library
Academic Publishing	Proprietary digital libraries for electronic access to academic publishing	Emerald, Elsevier
Academic Contents and Exchanges	Electronic collections of course materials and learning objects	JSTOR, MIT Open Courseware
Database Management Systems (DBMS)	Set of computer programs that control the creation, maintenance, and the use of a database.	Student records
Data Warehouse	A repository that facilitates reporting and analysis of data	Financing data, budgeting data
Data Mining	The process of extracting patterns from data	Academic profiling
Groupware	Is designed to help people involved in a common task achieve their goals	Knowledge Forum, Synergeia, Wikis
Communities of Practices (CoP)	Groups of practitioners networking in a particular fields of endeavor to define a practice and knowledge domain	Consortia, Educational Research Services
Social Communities of Interests	Social networks drawn together to share knowledge and build relationships	Facebook, MySpace, Flickr
Individual Communities of Interests	Tools for individuals to manage personal knowledge and networks	Blogs, Twitter

KM Processes

KM processes refer to a systematic approach to the identification, capturing, organization and dissemination of the intellectual assets that are critical to the organization's long term performance (Shukor *et al.* 2009). KM processes help in turning an organization's intellectual property (recorded or expert of its members) into a greater productivity, new values and increased competitiveness. KM processes can also be viewed as turning data into information and transforming information into knowledge and is a cyclic process involving various activities including knowledge creation, knowledge codification, knowledge transfer, and knowledge application (Nonaka, 1991). To create a comprehensive and working KM framework, an organization has to provide for the whole knowledge lifecycle. To achieve this, we identify key KM processes with the ultimate stress and goal on optimization of knowledge use to develop our framework. The processes identified can coexist and act simultaneously within a KM framework system contributing to KM effectiveness and efficiencies and include *knowledge planning, knowledge capture, knowledge organize, knowledge retrieve, knowledge utilize, knowledge maintenance,* and *knowledge evaluation.* Table 2 below gives a summary of the theoretical models identified by different authors that attempt to explain how organizational knowledge is created, transferred, and crystallized and these were used to guide in identifying key KM processes for our framework.

Table 2: *KM Processes*

Author/s	**KM Processes**
Wiig (1993)	Creation; Manifestation; Use; Transfer
Nonaka and Takeuchi (1995	Socialization; Internalization; Externalization; Combination
Andersen and APQC (1996)	Share-create; Identify; Collect; Adapt-organize; Apply
Ruggles (1997)	Generation; Codification; Transfer
Van der Spek and Spijkervet (1997)	Develop; Distribute; Combine; Hold
Angus et al. (1998)	Gathering; Organizing; Refining; Disseminating
Holsapple and Joshi (1998)	Acquisition; Selection; Internalization; Use
Jackson (1999)	Gathering; Storage; Communication; Synthesis; Dissemination
Davenport and Prusak (2000)	Generate; Codify; Transfer
Tannenbaum and Alliger (2000)	Sharing; Accessibility; Assimilation; Application
Alavi et al. (2001)	Creating; Storing/Retrieving; Transferring; Applying
Heisig (2001)	Create; Store; Distribute; Apply
Probst et al. (2002)	Identification; Acquisition; Development; Distribution; Utilization; Preservation
Tyndale (2002)	Creation; Organization; Distribution; Application
Rollet (2003)	Planning; Creating; Integration; Organizing; Transfer; Maintenance; Assessment

In the proposed framework, *knowledge planning* involves matching the context that knowledge is used in (Baets 2005; Raghu and Vinze, 2007) and lays the basis for a KM framework by setting knowledge normative, strategic and operational goals; identifying the core business processes and establishing the role that information and knowledge play in them; *knowledge capture* involves the extraction of useful knowledge from vast and diverse sources of information as well as its acquisition directly from users; *knowledge organizing* aims at providing clear and efficient ways of retrieving knowledge, extending it, or acquiring an overview on a certain matter, helping in intelligent and meaningful processing of information, as well as enabling better communication between various parties; *knowledge retrieve* consists of search and decoding processes where search is the process by which retained information is selected as relevant to a particular problem or goal and decoding is the reconstruction of the selected information to satisfy the user's request; *knowledge*

utilization refers to the transformation of knowledge to products and services; *knowledge maintenance* involves ensuring that knowledge is accessible, correct and updated; and *knowledge evaluation* aims at effectively coordinating knowledge strategy with operational practices so as to get a better control over knowledge resources and knowledge reuse.

Leadership

Leadership is a constituent part of the three elements of the framework: higher education process/knowledge activities, enabling ICT and KM processes. KM involves implementing changes that may not easily gain acceptance in organizations unless the leadership mobilizes the support of all knowledge users to provide a conducive environment for widespread sharing of knowledge. Leadership roles in KM include overcoming resistance to change and dismantling barriers to communication, both across the organization and between different levels of management. This is because it nourishes the culture and climate for KM through building of executive support and championing of KM. The major sub-elements of leadership in the proposed framework include business culture, strategy, policy, climate, motivation, change management and communication/awareness (Pan and Scarbrough, 1998)

Organization

Organization is another constituent part of the three elements of the framework: higher education process/knowledge generating activities, enabling ICT and KM processes. The value of knowledge creation and collaboration should be intertwined throughout an organization and operational processes must align with the organization's KM framework and strategy, including all performance metrics and objectives. While operational needs dictate organizational alignment, a KM framework must be developed to facilitate KM throughout higher education institutions. Organization structure is vital for how it harnesses the knowledge, and strategically directs it towards agility and competitiveness. Introducing KM requires organizational change and inevitably acts as a catalyst to transform the organization culture. In order to effect changes in the higher education sector, KM must be part and parcel of the higher education process, enabling ICT and appropriate KM processes. The major sub-elements of organization in the framework include process work flows, organization structure, process reengineering, total quality management, metric standards, and hierarchy of authority.

KM Outcomes/Educational Goals

This is the last element and it constitutes the output component (educational goals) of the proposed framework. KM outcomes refer to knowledge behaviors of individuals or groups of individuals that contribute to improve learning/work related outcomes (Muhammed et al. 2008). A key outcome of effective KM at the individual level is to have the right knowledge at the right time so that appropriate, value-added, and creative actions can be enacted by those accessing the knowledge. This paper adopts Yoshioka's et al. (2001) knowledge framework for communicative actions consisting of conceptual, contextual, and operational knowledge to arrive at the KM outcomes of the proposed framework. Conceptual knowledge is the individual's understanding of why a person needs to take specific action to complete the task (know-why) (Kim, 1993). Contextual knowledge is an individual's understanding of the contextual factors surrounding the task at hand, such as the knowledge related to the people (know-who), locations (know-where), and timing (know-when) necessary to complete the task (Earl, 2001). Operational knowledge is the individual's understanding of task requirements (know-what) and the processes of how to accomplish the task (Dhaliwal and Benbasat, 1996). In addition to the above, other KM outcomes that were identified include innovations, competitiveness, performance enhancement, decision supports, productivity and effectiveness.

The proposed framework as shown in figure 1 delineates the relationships and interplay that exist between higher education process, enabling ICT, KM processes and KM

outcomes/educational goals which form the key elements of the framework. As was pointed out earlier, organization and leadership are considered as separate entities within the proposed framework, but which have direct influences on how higher education process, enabling ICT and KM processes can perform to achieve higher educational goals reflected by KM outcomes. Stankosky's (2005) KM pillar to enterprise learning was used in the approach to guide the identification of the key elements of the framework because of its learning orientation, while the task/technology fit theory (Goodhue and Thompson, 1995; Zigurs and Buckland, 1998) provided the theoretical basis for developing a framework that presents the relationships and interplay between higher education process, enabling ICT, KM processes, and KM outcomes. The elements of the framework and the interplay that exist between them is based on the understanding that technologies must be utilized and should fit the task they support to have a performance impact. This is only possible if the technology features represented by enabling ICT are well aligned with the higher education process and KM activities. Proper alignment will lead to better utilization of ICT and subsequent performance improvement as is represented by knowledge outcomes in the proposed framework. To arrive at the proposed framework, key higher education process are matched with KM enabling ICT, and critical KM processes as summarized in Table 3.

Table 3: *Interplay between Higher Education Process (Knowledge Generating Activities), KM Enabling ICT and KM processes*

Higher Education Process / Knowledge Generating Activities	**KM Enabling ICT**	**Critical KM Processes**
Academic Services and Learning		
Teaching	Knowledge Portals, E-Document Mgt Systems, Academic Publishing, Academic Content, DBMS, Groupware, CoP, Social Communities of Interests, Individual Communities of Interests	Knowledge Planning, Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize, Knowledge Maintenance, Knowledge Evaluation
Learning	Knowledge Portals, E-Document Mgt Systems, Academic Publishing, Academic Content, Groupware, CoP, DBMS, Social Communities of Interests, Individual Communities of Interests	Knowledge Planning, Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize, Knowledge Maintenance, Knowledge Evaluation
Research	Knowledge Portals, E-Document Mgt Systems, Academic Publishing, Academic Content, Groupware, CoP, DBMS, Social Communities of Interests, Individual Communities of Interests	Knowledge Planning, Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize, Knowledge Maintenance, Knowledge Evaluation
Outreach services	Groupware, CoP, Social Communities of Interests, Individual Communities of Interests	Knowledge Retrieve, Knowledge Utilize
Content development	Academic Content and Exchanges	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize, Knowledge Maintenance, Knowledge Evaluation
E-Learning	Knowledge Portals, E-Document Mgt Systems, Academic Publishing, Academic Content, Groupware, CoP, DBMS, Social Communities of Interests, Individual Communities of	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize, Knowledge Maintenance, Knowledge Evaluation

Higher Education Process / Knowledge Generating Activities	**KM Enabling ICT**	**Critical KM Processes**
	Interests	
Student Life-Cycle Management		
Student recruitment	DBMS, Data Mining	Knowledge Capture, Knowledge Organize, Knowledge Retrieve
Student records	DBMS	Knowledge Capture, Knowledge Organize, Knowledge Retrieve
Student admission	DBMS, Data Mining	Knowledge Capture, Knowledge Organize, Knowledge Retrieve
Student finance	Data Warehouse, DBMS	Knowledge Capture, Knowledge Organize, Knowledge Retrieve
Student advice	Data Mining	Knowledge Capture, Knowledge Organize, Knowledge Retrieve
Institutional Development		
Market research	Knowledge Portals, DBMS, Data Warehousing, Data Mining, Knowledge Portals, Groupware, CoP, Social Communities of Interests, Individual Communities of Interests	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize
Resource mobilization	Knowledge Portals, DBMS, Data Warehouse, Data Mining, CoP, Social Communities of Interests, Individual Communities of Interests	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize
Alumni management	DBMS	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize
Partnerships	DBMS, Knowledge Portals, Groupware, CoP, Social Communities of Interests, Individual Communities of Interests	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize
Academic profiling	Data Mining	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize
Enterprise Management and Support		
Human resource management	DBMS, Data Warehouse	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize
Corporate services	Knowledge Portals, DBMS, Data Warehouse, Data Mining	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize
Operation support	Knowledge Portals, DBMS, Data Warehouse, Data Mining	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize
Financial management	Data Warehouse, DBMS, Data Mining	Knowledge Capture, Knowledge Organize, Knowledge Retrieve, Knowledge Utilize

This paper conceptualizes organization in the proposed framework as a knowledge space where the required ICTs and agents, individuals and collectives who use them in the conduct of their knowledge work are embedded. To address the entire KM processes in organization, the development of the framework takes cognizance of the notion of systems thinking. Systems thinking is important for KM in organizations because it encourages consideration of

the entire KM processes and facilitates the linkage between KM initiatives and the strategic goals and objectives of the organization so as to maintain a clear vision of what is being done and why it is being done (Gao et al. 2002). In higher education setting, the KM processes is an ongoing tasks that is necessary to update existing knowledge base, detect an opportunity or need, identify relationships between newly discovered knowledge, and define a desired state that may be a goal or direction recognized as possible after analysis of new knowledge. The KM processes is also responsible for analysis of the relevancy of acquired knowledge and verifying their relevancies. By going through these processes, a knowledge seeker should be able to use the result of the analysis from any of the seven KM processes proposed in the framework, in combination with the individual's tacit and experiential knowledge derived from higher education process using appropriate enabling ICT to achieve an objective of a search to support a decision-making process. In line with Wong and Aspinwall (2004) proposed guidelines for developing an effective KM implementation framework, the proposed conceptual framework tries to address most of the issues raised in the guidelines by having a clear structure that provides direction on how to conduct and implement KM; it highlights key higher education process involved in generating different knowledge resources/types, and appropriate enabling ICT for managing the generated knowledge; it highlights the necessary KM processes or activities which are needed to manipulate the available knowledge; it includes leadership and organization which are the influences or factors that will affect the performance and bearing of KM; and it provides a balanced view between the role of technology and of human beings in KM.

RESEARCH ISSUES ON USING ICT FOR KM IN HIGHER EDUCATION

Evidence from available literature indicates that there are still broad arrays of research issues in using ICT to enhance KM in higher education. Although a lot of theories exist on KM, the theoretical basis for using ICT to enhance KM in higher education is still weak, and practiced-based implementations prevail. In addition, not much empirical assessments have been undertaken on related issues resulting into large gaps existing in the current body of knowledge that would help in addressing emerging challenges. This section aims at highlighting the research agenda that can be useful in bridging these gaps.

ICT and KM processes in higher education: The use of ICT in enhancing KM processes can be valuable for higher education in a positive (enhancing and enabling) and negative (blocking and frustrating) ways. ICT can enhance the knowledge content of the services and products, and can facilitate as well as hinder the processes of knowledge acquisition, dispersal, application and retention. To address these challenges require carrying out researches on appropriate KM processes, how the use of ICT affect these processes, and the interplay and relationships between the different KM processes.

ICT and KM for collaborative learning: Collaborative technologies and KM both have significant contributions to make in higher education, but many organizations have yet to adopt them both systematically and strategically because of lack of well researched approaches. We are living in a knowledge-based society where value is created through complex dynamic exchanges between individuals and organizations based on a relationship capital through collaborations which create tangible and intangible value. Collaborations requires more than the ability to publish, display or aggregate information but rather through the ability to leverage the know-how of many individuals which can only be achieved through continuous research.

ICT, KM and people: Most KM approaches have a tendency to focus on tools, good practices and methods, rather than organizational processes based on knowledge needs of users such as incentives, attitudes, language, culture, and individual knowledge needs. The success of KM initiatives does not simply depend on documenting, managing, and archiving of generated knowledge, but require further research to ensure that knowledge and evidence of what works are contextualized, enriched, interpreted, debated and disputed in order for

learning to occur among a multitude of stakeholders with divergent interests and world views (Keijzer et al. 2006).

ICT, organizational strategy and higher education: According to Hendriks (2001), knowledge is not organizationally relevant as such, but is relevant when and in the way an organization recognizes its relevance or mentally constructs it. The organization's vision, mission and competitive strategy, when translated into KM policy should provide the criteria for assessing the organizational relevance of knowledge. To address these require further research in determining the relevancy of ICT in achieving higher education KM strategy, the level of ICT support and the choice of each individual ICT applications.

Measurement and evaluation of KM: Although current KM approaches and strategies show promise of future potential, there is still inconclusive evidence of success in achieving higher educational goals. This is mainly because of lack of critical mass/impact evidence for research purpose and lack of effective measurement tools that go beyond output-based evidences. The elusive and often tacit nature of knowledge also makes it very difficult to grasp concrete effect or even direct results from its application. There is a need for a better approach for measuring and evaluation of knowledge management performance. KM involves internal changes in operational practices and knowledge users are the final arbiters of KM practices. It is only when knowledge users are satisfied with implemented KM practices and strategies in higher education that they will voluntarily participate in creating and sharing knowledge in their organizations. This can only be achieved through carrying out further research.

***KM capabilities and infrastructure*:** Higher education institutions possess various knowledge resources and the infrastructure to exploit them. However, the coordination of the available knowledge resources and the infrastructure to exploit them is still a big challenge. Determining the interrelationships that exist between the knowledge resources and KM capabilities is a critical area that requires further research.

CONCLUSION AND FUTURE DIRECTION

This paper proposed a conceptual framework for using ICT to enhance KM in higher education and identified several outstanding research issues to bridge the current existing gaps between the requirements of theory building and testing to address the different emerging challenges in using ICT to enhance KM in higher education. The framework highlights the relationships and interplay between higher education process, KM enabling ICT, KM processes, and KM outcomes as constituting the key elements of the framework and points out essential issues and requirements for developing the framework. In the proposed framework, leadership, and organization are considered as constituent part of higher education process, enabling ICT and KM processes. From a theoretical point of view, the proposed framework gives a first understanding of a methodology for developing a framework for using ICT to enhance KM in higher education by defining the key issues that should be considered when developing an effective KM framework, while the research agenda highlight new areas for further research that should be tackled to address emerging challenges.

Because of the complex and multi-faceted nature of organizational learning and KM, and taking into consideration the fact that no single or optimum approach to organizational KM and KM framework development currently exist, this paper adopted Stankosky's KM pillar to enterprise learning together with the task/technology fit theory to guide the development of the framework. This led to the identification of the key higher education process involved in generating knowledge, enabling ICT, KM processes, and KM outcomes; as well as the relationships that link them together. By showing these relationships, this paper provides a systematic guideline for KM framework development through adoption and use of ICT and the required KM technical functions to support higher education process and activities. Although the paper is based on synthesis of several pieces of extant research and therefore still requires empirical evaluation and testing, it is hoped that the ideas, conceptual approach,

discussion, and research issues set forth in this paper represent a contribution to the literature on KM, higher education, and ICT use for each area and should stimulate interest and future work by KM researchers.

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