Journal of Information Technology Management

ISSN #1042-1319

A Publication of the Association of Management

AN INDUCTION MODEL OF INFORMATION TECHNOLOGY ENABLED KNOWLEDGE MANAGEMENT: A CASE STUDY

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ABSTRACT

Knowledge management (KM) has become an important discipline in the field of management. Yet, few induction models of IT enabled KM are available for research and teaching in the literature. This paper presents the development of an induction model based on five real-life cases of successful KM. Based on a so-called Joint Qualitative Analysis, this case study has identified several common aspects of the IT enabled KM process. In brief, KM occurs when the new business strategies of the organization requires KM. New IT strategies and new organizational strategies are then developed to align with the new business strategies to implement KM. A crucial component of the IT enabled KM is the development, the use, and the maintenance of IT supported products and services for KM. The IT supported products and services foster the transformation between information, and explicit and tacit knowledge. The development of metrics and measures for KM assessment is a key task of the KM process. The induction model is significant as it supports KM process design in the context of IT applications.

Keywords: Knowledge management; knowledge management process; IT enabled knowledge management; induction model; case study; joint qualitative analysis.

INTRODUCTION

Knowledge management (KM) has become one of the important topics of study in the management literature [1,11,23,49] as well as an emerging academic discipline [22]. Many journals have been devoted entirely to KM research during the past decade, and a number of traditional human-systems journals have published special issues focusing on KM. KM is an overarching concept covering a variety of fields that extends into general management [6], information systems development [38], information resource management [35,46], information technology (IT) management [24], decision support systems [25,36,45], artificial intelligence [28], and human resource management [37]. Recently, several business schools have established MBA programs with concentration on KM [50].

Given the great breadth of the subject and how the subject has diffused throughout the business field, it is natural that there are a variety of approaches to modeling KM. There are a variety of classic KM models, such as the OODA loop [18], the PDSA cycle [12], the knowledge transformation models [33,34], the organizational learning and knowledge sharing models [3,4,21,40,47,48], the KM causal model [13], and the knowledge engineering model [10]. Yet, few models that concentrate on the IT enabled KM process can be found in the literature, despite the fact that contemporary KM must be facilitated by IT [7,9,19].

In its broadest definition KM is the process that generates value for the organization through the use of its intellectual and knowledge assets [16,20,39]. The major task of modeling such a process is the development of an induction model. Induction is generalization from specific instances [5] that is process-oriented rather than decision-oriented [15]. A generalized induction model provides a base for a design process as a means of approaching managerial problems [41]. An induction model can be developed through real cases qualitative studies [17,51], and then can be applied to organizations for KM. This study is to develop an induction model of the IT enabled KM process in organizations. The remainder of the paper is organized as follows. Section 2 explains the research design and data collection procedure. Section 3 presents an overview of the KM cases used for this study. Section 4 describes the qualitative data analysis procedure and the findings. Section 5 formalizes the induction model for the IT enabled KM process. Section 6 discusses the limitations of the study. Finally, Section 7 provides concluding remarks.

RESEARCH DESIGN AND DATA COLLECTION

The Case study has been a methodological approach used in information systems research for decades. Research [17] has called for more rigor in case research, and has identified three major attributes used for case studies: research design, data collection, and data analysis [14]. These major attributes for this study are described as follows.

Research design

IT has been central to many KM initiatives. There is little doubt that IT can be a benefit in KM when it supports the development and communication of human meaning and tacit knowledge [31,44]. However, despite the close connection between KM and IT, few models of the IT enabled KM process have been discussed in the KM literature. This study is to develop an induction model of the IT enabled KM process based on successful KM cases and to emphasize the IT enabled KM process for organizations. The components of the research question of this study include why the organizations need KM, what the key aspects of the IT enabled KM process are, and how these organizations implement the IT enabled KM process.

This study is to develop an induction model by using multiple-case design to make the model capable of providing a generalized conclusion. The original multiple cases were written by twelve participants of an IT enabled KM workshop. The authors of these individual cases were all insiders of KM in their organizations and possessed first-hand KM experiences. These participants' KM related job responsibilities varied; however, each participant worked in her/his case organization for at least five years. These participants were also the team of a so-called Joint Qualitative Analysis (JQA) process in qualitative data analysis, as explained later in this paper. The major task of this study was to select the most considerable cases from the original set of cases, to coordinate JQA sessions, to summarize the findings, and to formulate the induction model. The tactics applied to this study were to explore all available cases, to assess the quality of each case, to select cases with high presentation quality and significant KM in the organization, and to search for cross-cases similarities.

Qualitative Data collection

The major tactic used for data collection of this study was data triangulation [27] which combines multiple data sources to make the findings of this study convincing and accurate. The protocol applicable to this study consisted of the general rules and procedures of case writing that followed typical structure of case study protocols [51], as shown in Table 1.

Table 1. Outline of the Protocol Used in the Study

Protocol Sections	Protocol Components
1. An overview of the case	Objective: To understand IT enabled KM process Topics investigated: KM and the IT enabled KM process Key issue: Common patterns of successful IT enabled KM as a long-term process
2. Sources of information	Direct observations Direct action experiences Documents Archival records
3. Case study questions	Why does the organization need KM? What are the key aspects of the IT enabled KM process? How does the organization implement the IT enabled KM process?
4. A guide for case report	Format of case report Terminology

Twelve (12) candidate KM cases were collected from the KM workshop. Our observations on the first-hand KM cases suggest that IT enabled KM is not a particularly applicable approach for typical small organizations which are isolated from large social networks. All organizations of the candidate cases for this study are middle or large organizations in the New England of the United States.

The twelve candidate cases were distributed to all participants for assessment and selection of high quality cases for this study. The following five key features were used as the criteria for the assessment of all cases.

- The context and the theme of the case is relevant to IT enabled KM.
- The IT enabled KM has resulted in significant positive impact for the organization.
- The IT enabled KM process has intensively involved the knowledge workers in the organization.
- The case provides wealthy information of the IT enabled KM process.
- The case is original, is well organized, and has quality of presentation.

As a result of the assessment, five cases with the overall higher ranks were considered to contain qualitative data for this study.

CASES OF KNOWLEDGE MANAGEMENT

This section is an overview of the cases of KM that were successfully identified in five middle or large size organizations from the New England region.

Case 1

Organization A is a commercial wholesale broker of a large insurance company, specializing in 18 programs that write insurance policies for groups of businesses including home inspectors, architects, engineers, alarm contractors, and railroad protective liability.

The company wrote policies with premiums that are about 4% less than other brokers. The wholesale broker was given a very aggressive growth target which could be impossible to meet given the current method of doing business. There was significant lost business because the information process did not allow underwriters to view all the needed quotes within the timeframe. An underwriting manager complained that his staff was unable to produce about 80 quotes each month, resulting in about 20 million dollars of lost sales each year. The turnover rate of operation staff was high, and a quality check on each policy was required. This requirement delayed the issuance of any policy.

The management of the company realized that they need a new business strategy: to improve the quality of customer services and the quality of policy documentation. To implement this new business strategy, the company promoted the Virtual Office concept by creating an organizational Web portal that was available 24/7 for agents around the country. The Web portal connected people to content. For example, an underwriter was able to have all quote information, policy coverage, and claim history instantaneously and all in one place. An agent could receive a quote in less than 5 minutes. The portal helped the company get closer to their customers, and kept copies of the policies online. Underwriters, accounting personnel, and claim adjusters were able to access and view the policies online.

The fixed office system was beginning to erode as agents recognized the benefits of flexibility in response to the market condition. As a result, agencies were mov-

ing toward the virtual office system. The roles of middle level managers were changing from providing their own direct management within the office to coordinating and monitoring the performance of the agents online.

To promote the use of the online system, the company offered prizes to those who actively used system. About six months after the live production, the company hired an outside firm to conduct a survey of the agents' experiences with the new system. The survey came back with a number of complaints, but overall the agents' experiences were positive. The survey continued to be taken every 6-12 months with the feedback for improvement.

The company had continued to develop new products for the Web portal with claim databases, inspection services, and a compliance system. The project team was expanded to include a number of business analysts, new personnel for data security, Web masters, and database administrators. The company also increased its marketing staff to develop new markets through its virtual office system.

The culture at the company was a hands-on issue for the new system, and trust was beginning to develop. For instance, pricing structure screens were implemented for products so that the underwriter was able to see how the quote was determined without pulling the elusive underwriting file.

The Virtual Office became the center of knowledge management. Nearly 5 years after the first quotes were issued online, the number of brokers/agents using the system has grown to nearly 4,000 with 9,500 individual users. The company's premium revenue has tripled during the same period.

Case 2

Organization B is dedicated to providing high quality care and learning for young children through 15 early learning centers.

In 2003 the industry of early childhood education saw a huge shift. Large, multi-site companies began acquiring smaller centers specializing in regions, and creating standards to assure uniform policies, curriculum, facility design, and equipment throughout all of their centers. With the increasing competitiveness in the field of early childhood education, Organization B focused on distinctive competency; that is, it allowed autonomy for each center. Although the organization had uniform policies and procedures, directors at each center were allowed flexibility to some degree when enforcing policies and procedures based on the needs of the children, the families, and the staff in each community.

The organization created an e-training system to develop and manage skill sets for teachers and administrators, share services across all of the centers, create assessment tools for progress, and accelerate the transfer of knowledge to staff and to customers.

The first step of the development of the e-training system was the creation of online policies and procedures. "Gatekeepers" were appointed to maintain the online policies and procedures. Online workshops for managers, trainers, and child development associates were conducted regularly.

The organization conducted various team-building activities throughout each layer of the service teams to initiate bonding and building trust. Several overnight camping retreats and face-to-face meetings were undertaken. Team leaders and active team members were rewarded with gift certificates, books, and recognition in the organization's online newsletter.

Each center was audited for the quality of online training, and was given scores out of 100. Parent surveys were completed twice per academic year to assess the quality of the program. Employees' satisfaction surveys were also conducted twice per year. The overall enrollment of children increased by 10% during the past 2 years.

Case 3

Organization C is a global entity that provides business and consumers with logistic solutions. The firm provides various levels of services from vehicle lease/rental to facilitated material movement.

As a supply chain transportation provider, Organization C expanded its business into Thailand and other Asia regions after 40 year operations in US, UK, and Canada. In the global society, coordination and training were critical for the success of the transportation business, but the costs of meetings and training were prohibitively high.

Organization C initiated a virtual training program. It hired a vendor to install and maintain the system for the virtual training programs, and the vendor provided user training for Organization C.

The virtual training program was developed internally and was used to train new employees. In collaboration with online universities and the virtual training program, online training courses were developed, and many employees received degrees through the program. The employee surveys indicated that job satisfaction on an

average in the organization increased by 0.4 on a 7-point scale.

Case 4

Organization D is a medical equipment engineering company. The company produces disposable surgical instruments and implantable products such as CSF drainage systems.

As the global business trend moved toward outsourcing manufacturing at a lower cost, Organization D must constantly review the internal improvement process efficiencies to reduce the standard cost to be competitive. To survive, the company adopted a project-oriented structure, and knowledge sharing among the stakeholders of a project became vital for the projects' success.

The company had several systems for knowledge sharing. FLEX was a documentation vault designed to store and capture historical information on any projects of the company. Various versions of the same project were available for reference. QR (quality requirements) was dedicated to numerous aspects of the quality system aligned with FDA and ISO requirements. E-Training was an online training system to satisfy the employees' competencies in FDA and ISO requirements. E-Meeting was a comprehensive area to gather work-in-progress documentation for project team members. All these knowledge sharing systems were protected for tracking and property reasons.

The company offered monetary bonuses to project teams based on the value of the project (e.g., patent), and each project team distributed the monetary awards to individuals. Trust among team members has been a part of the culture of the company. After each project, the company organized meetings for "lessons learned from the project". The sales of the company increased 15% during the past four years.

Case 5

Organization E is a telecommunication wholesale company. The company has unparalleled expertise and experience in delivering innovative wholesale telecommunication services. It offers diversified products with high performance and reliability. The products and services are available in the global network to communication providers worldwide who then resell services to end users under agreement.

The telecommunication business is highly innovative as well as competitive market. To be profitable, the company must respond to the ever changing market. The company initiated Sales Engineering Teams to assume the leadership role in providing pre-sale technical and engineering support, and implementing consulting for their international retail customers. The tasks of Sales Engineering Teams were to identify and qualify new sales opportunities, to establish and maintain relationships with customers, to participate in customer meetings/calls that drive sales activities, to develop technical solutions for customers, and to review non-standard and complex customer requirements.

Each Sales Engineering Team consisted of about 10 people and was responsible for about 200 customers. No single person in the team was capable for the response to all the requests from the clients. Team members must rely on knowledge sharing and learning. A team was comprised of Subject Experts with varied technical expertise. The team leader was the interface with other business entities (e.g., account teams and sales teams) and the coordinator of the team activities.

Sales engineers were compensated with a base salary and commission associated with sales, and exemplary work was rewarded with other incentive programs or recognition. Team members negotiated expectations for the team, and coordinated the pooling of the resources for projects.

The company had a Web portal for all sales engineering teams to share technological information. Sales engineering teams used a variety of tools such as TCOMs, F&E, TIRKS, CNE, standard Microsoft suites. Real time exchanges were needed for virtual meetings. Each team has a cybrarian who categorized forum discussions, blogs, chats, etc. to build the knowledge sharing environment, ensure shared knowledge updating, and the avoidance of reinventing the wheel.

According to the company's statistics, the sales engineering team approach reduced the length of time to respond to RFP and designs of products for customers by 50%.

JOINT QUALITATIVE ANALYSIS

Qualitative data analysis has been a central issue of case studies [32,43]. Coding is often applied as a tool to facilitate discovery and further investigation of the qualitative data [29,42]. Nowadays, the use of computer qualitative data analysis software allows for the elimina-

tion of, or at least a reduction in, manual coding. Codes provide indications of threads and patterns of qualitative data, but do not provide the context of the words. Semantics and pragmatic meanings of qualitative data more or less depend upon individual analysts' interpretations of coded files. In our case of induction modeling, coding the transcripts was not found to be effective because of diversified semantics and pragmatic meanings in multiple cases. The JQA process was applied to analyze the five cases. JQA is a team-based qualitative data analysis approach. Although its concept is not completely new, the JQA approach has not been well documented in the literature, and is an original approach to case studies (cf. [14]). JQA involves all case owners to generate an exploratory summary of the cases. A case owner can be the author of the case or the key participant of the organization of the case. In our case study, each case author was the case owner. The JQA process is based on the premises that case owners have the best understanding of these cases and the best case data are analyzed when all of these case owners work together on a project as a team. The JQA approach is radical as qualitative data analysis becomes a product of knowledge sharing, rather than a subjective pursuit. In the view of reliability of case studies [51], JQA reduces risk of misinterpretation of cases to minimum. It is clear that, for an expanded study involving a greater number of case owners, JQA would be costly and would require significant amount of effort to coordinate.

The objective of the JQA of this study was set to generate a case level exploratory meta-matrix. The meta-matrix focused on a consolidation of cases to fully recognize the relevance of cases through identifying common patterns within the cases. The meta-matrix visually compared the cases to ensure the context of the cases and the patterns observed were relevant to the current study. The objective of JQA was feasible given the reasonable number of cases and the willingness of the case owners.

In this study, all twelve workshop participants joined JQA. One of the authors of this paper was the case study moderator and coordinated all sessions. A JQA session was a knowledge sharing meeting of three hours that engaged the attendees to participate in discussions. At the first JQA session, each case owner distributed her/his written case and verbally presented it for about thirty minutes. Each subsequent JQA session had three sub-sessions: open meeting (a half hour), group meeting (one and a half hour), and joint discussion meeting (one hour). In each open meeting sub-session, the moderator recapped the analysis results of the previous session, and specified tasks for the current session. In each group meeting sub-session, the entire team was divided into three equal groups such that each participant had the opportunity to work with different group members each time. In each joint discussion sub-section, groups presented their analyses to all participants followed by an open discussion.

The JQA sessions placed emphasis on generating a meta-matrix of the cases to highlight common aspects of the IT enabled KM process. After four JQA sessions the team reached a consensus on the meta-matrix. A brief version of the meta-matrix is exhibited in Table 2. The table reveals key aspects of the IT enabled KM process: new situations, new business strategies, IT strategies for KM, organizational strategy for KM, KM products/services, and KM outcomes. Specifically, the IT enabled KM is activated by a new business situation. New IT strategies and new organizational strategies are developed to align with the new business strategies to implement KM. A crucial component of the IT enabled KM is the developing, the using, and the maintaining of the KM products and services for the organization. The KM products and services will foster the transformation of information, explicit knowledge, and tacit knowledge. The development of metrics and measures for KM assessment is a key task. It becomes clear that the success of KM increases with the success of the business.

THE INDUCTION MODEL OF IT ENABLED KNOWLEDGE MANAGEMENT PROCESS

The meta-matrix developed by the JQA was applied to the following research question components: why the organizations need KM, what the key aspects of the KM process are, and how these organizations implement the KM process. Clearly, KM is a continuous process. It is not a static blueprint; rather, it is a recipe which defines the course of action that may requires varying amounts of improvisation. To develop a conceptual framework, the set of KM aspects in the meta-matrix were further elaborated and generalized.

The Need for KM that aligns with the business strategy

KM is requested by new business strategies in response to the ever changing business world; however, KM is not a panacea for all kinds of business problems. The premise of KM is that the organization is knowledge intensive. KM is initiated by the need for knowledge sharing and transference among knowledge workers who are playing leading roles in the business operations of the organization, or for the needs of extensive training for knowledge workers. KM can be a successful practice when KM fits in the business strategy of the organization. Generally speaking, when an organization is moving from product-driven to market-driven, to knowledge-driven strategies, KM would provide a competitive advantage to the knowledge-driven organization.

IT strategies for KM

The first dimension of the IT enabled KM for management to consider is IT strategies that create the best technological environment for KM. An IT strategy for KM provides a vision of how the knowledge-driven organization uses IT to implement its business strategies through KM. The components of this dimension of KM include:

- IT infrastructure (e.g., computer hardware, software, networking, and information repository systems) for KM,
- code of ethics and policies related to the IT use for KM,
- networked virtual team without physical barriers, and
- architecture of the knowledge systems (e.g., groupware and other KM tools).

The IT strategies for KM can affect and are affected by changes of the need for the IT enabled KM that aligns with the business strategies in the organization. However, successful IT strategies for KM are driven by the business strategies that demand KM for the organization.

Organizational strategies for the IT enabled KM

The second dimension of the IT enabled KM is organizational strategies that create best environment for KM. An organizational strategy for the IT enabled KM provides a holistic vision of how management designs the organizational structure, coordinates and controls the KM process to implement its business strategies through KM. The components of this dimension include:

- new organizational entities or functions for KM,
- cultural changes, trust atmosphere for knowledge sharing,
- reward system for knowledge sharing and knowledge transfer, and
- plan of growth and retention of knowledge workers.

Successful organizational strategies for KM are driven by the business strategies that demand KM for the organization. The organizational strategy for the IT enabled KM and the IT strategy for KM of a knowledge-driven organization must complement each other.

IT supported products/services of KM

The third dimension of the IT enabled KM is the IT supported products and services. Contemporary KM must be facilitated by the IT supported products and services. The design and use of the IT supported products and services can have an effect on the KM objectives and outcomes. A KM process must have sub-processes of planning and monitoring of the IT supported products and services. The effectiveness of use of these IT supported products and services provides an intermediate indicator of an effective KM process.

Databases and knowledge repositories are examples of products for explicit knowledge sharing. Portals, blogs, and wikis are examples of products for explicit as well as tacit knowledge sharing. Video conferencing for collaboration and the virtual learning center for corporate training are examples of IT supported services. It is necessary for a knowledge-driven organization to design, implement, use, and maintain a wide range of IT supported products and services to facilitate both explicit and tacit knowledge sharing and transfer.

Outcomes of KM

The fourth dimension of the IT enabled KM is the outcomes of the KM process. The IT enabled KM process involves a substantial investment in IT and human capital. The organization must develop metrics and measures to assess the KM practice to justify whether the investment in KM results in a return for the organization. The development of metrics and measures is an essential part of the entire KM process. The outcomes of KM are often difficult to measure because of the unique characteristics of KM. First, the inherently intangible characteristic of knowledge makes measurement of KM difficult. Sec-

ond, KM is a long term and persistent process. It is difficult to assess outcomes of KM based on intermediate results. Second, KM is just one of many management streams in organizations. For instance, KM is often integrated into customer relation management, quality management, or project management. KM plays a catalytic role in enhancing the organizational competence and sustainability. Few feasible methods are available to separate the joint outcomes of all the management streams of the organization. Measures for KM could be subjective or objective [2]. Measuring of employees' job satisfaction, sharing of best practices, and improved communication are subjective outcomes of KM. Prompt responses to customers' needs, shorter product innovation cycles, and higher level of intellectual assets provide measures of objective outcomes of KM.

Induction model for KM

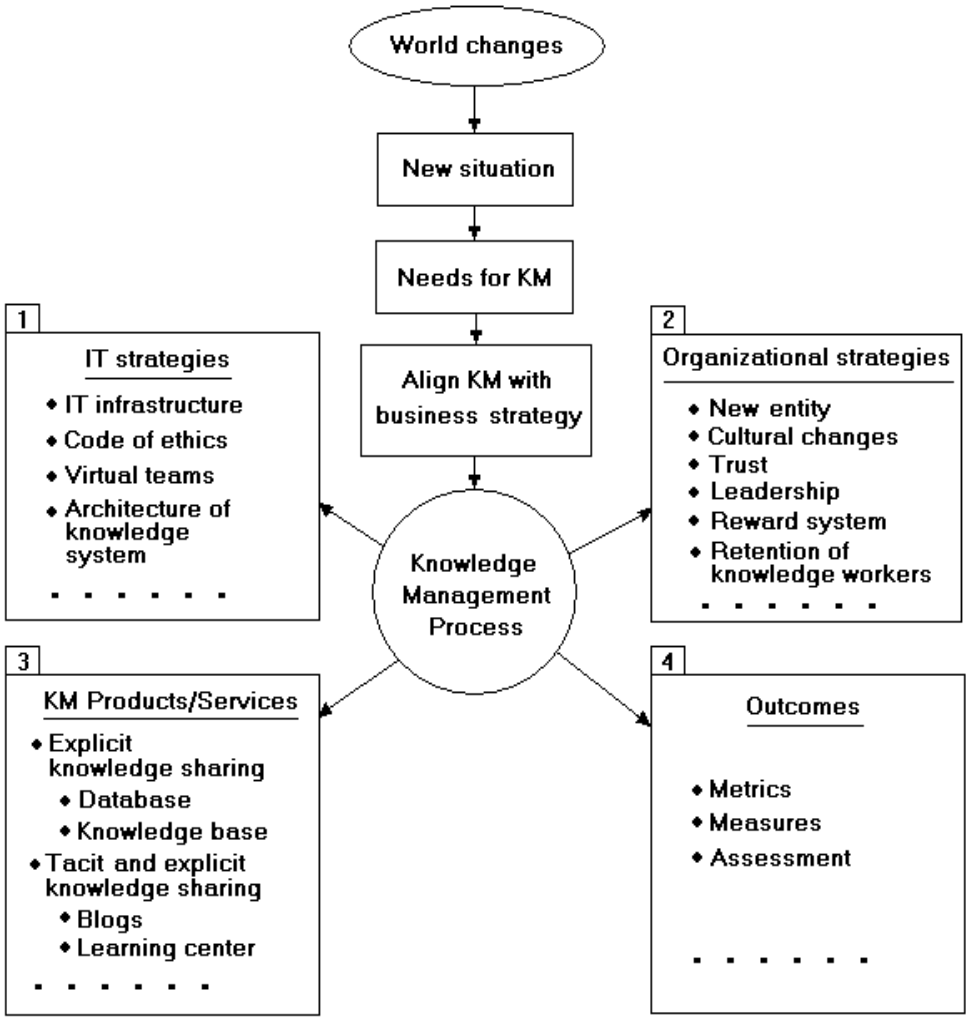
KM is a process-oriented management practice rather than decision-oriented process. The process-oriented management practice needs a rigorous body of knowledge in the design process as a means of approaching new business problems. To practice KM, the sponsor of KM must view the broad problem, develop a deep understanding of the issues, and plan a process to implement KM. The nature of KM is a long period project-based work flow around the problem, instead of a one-shot decision making process.

Induction is one of numerous unique aspects of process-oriented management practices [5]. Induction is generalization from specific instances and is the initial stage of process-oriented management practice. An induction model is a theory that is built on real-world cases and indicates the components and their most important relationships for consideration during the management process. To facilitate process-oriented management practices, induction models are needed. Specifically for KM, organizations need induction models for structuring the components and their relationships of the KM process. Figure 1 visually represents the relationships between the business strategies and the four dimensions of the IT enabled KM from the cases in our study.

Table 2. Meta-Matrix of the Knowledge Management Cases

	New Situation	Business Strategy	Needs for KM that fits business strategy	Organizational Strategy for KM	IT Strategy for KM	KM Products/ Services	KM outcome
Case 1 (Insurance)	▪Growth of business ▪Lost sales	▪To improve customer service and quality of documentation	▪ Knowledge sharing between agents and underwriters	▪Virtual Office system ▪ Trust culture ▪ Rewarding active users	▪Virtual team ▪New IT infrastructure	▪Web portal ▪Online Documentation databases	▪Revenue increase ▪More sign-up users
Case 2 (Pre-School Education)	▪Industrial merge	▪ Differentiation of services	▪ Develop and manage skill sets for teachers and administrators	▪To improve the quality of workforce ▪Recognition	▪Online training	▪Online databases ▪Online workshops	▪Children enrollment increase ▪Training scores
Case 3 (Logistic)	▪Globalization	▪To reduce costs	▪ Online training for its employees	▪To improve the quality of workforce	▪Virtual training program ▪Outsourcing IT infrastructure	▪Online credit courses ▪Online new employee training	▪Job satisfaction
Case 4 (Medical equipment)	▪Outsourcing in the industry	▪Project-oriented structure	▪ Knowledge sharing for project development and management	▪Project team building ▪Team reward system	▪Virtual project team ▪Intellectual property protection	▪Online databases ▪Online work-in-progress documentation ▪E-meeting	▪Sales increase
Case 5 (Telecomm.)	▪Product innovation	▪Sales-engineering-oriented structure	▪ Knowledge sharing among sales engineers	▪Sales engineering team building ▪Team reward system	▪Virtual sales engineering team ▪TCOMs, F&E, TIRKS, CNE	▪Web portal ▪Cybrarian	▪Short product development length

Figure 1. The Induction Model for the IT enabled Knowledge Management Process



CONTRIBUTION AND LIMITATIONS OF THE STUDY

Despite the significant progress in both theory development and practice, KM is still in its early stages, and KM processes are still improving. There have been many models for KM process, and each has its own focal point (cf. [8,13,30]). While the many concepts of the proposed induction model have been suggested in the existing KM process models, the proposed model is unique as it provides a holistic view of the IT enabled KM process through the integration of the fragmented concepts of KM into a concrete framework for organizations to systematically manage KM activities. A comparison of the proposed model with six other well documented KM models is exhibited in Table 3. As shown in Table 3, the proposed model is inducted from successful KM test cases directly. The model focuses on the synergic relationships between the business strategies, the organizational strategies, and the IT strategies of the KM process. The table explicitly reveals the IT supported products and services for KM, with an emphasis on business performance oriented KM.

outcomes.

Table 3. A Comparison of Our Model with Well-Documented KM Models

KM Models	The origin of the KM model	Synergy of business strategies, IT strategies, organizational strategies for KM	IT supported KM products/services	The overall theme of the KM model
OODA loop [18]	A strategic military framework of decision making cycle	It can be used for business at the strategic level, but deals little with organizational strategies and IT strategies for KM	Lack of aspect of IT supported KM products/services in decision making cycle model	KM in organizational learning and decision making cycle
PDSA cycle [12]	A process improvement and analysis tool in the management context	Lack of integration of business strategies, organizational strategies, and IT strategies for KM	Lack of aspect of IT supported KM products/services in the management cycle model	KM in organizational process improvement
Knowledge transformation models [33,34]	Theoretical model of knowledge creation in organizations	Little is explicit about the synergy of business strategies, organizational strategies, and IT strategies for KM	KM is supported by IT supported products/services	Tacit and explicit knowledge transformation
Organizational learning and knowledge sharing models [3,40]	Knowledge sharing is the central part of organizational learning	Lack of business orientation and explicit relationships between business strategies and IT strategies	The aspect of IT supported products/services is not a major dimension of this model	KM is a part of organizational learning process
KM causal model [13]	Empirical study through questionnaire survey	The model includes factors related to business strategies and organizational factors, but little is explicit about IT strategies in KM	Little is explicit about IT supported products/services that implement the IT strategies in IT enabled KM process	Factors of KM process and causal relationships between the factors
Knowledge engineering model [10]	A set of conceptual sub-models of knowledge engineering	The model specifies methods for computerizing human knowledge, but little is explicit about alignment of business strategies, organizational strategies, and IT strategies.	The model itself serves as IT supported services, but it does not emphasize the dimension of IT supported products/services for KM	Information techniques for knowledge analysis and information systems development for KM.
The proposed IT enabled KM process model	Successful IT enabled KM cases	The synergy between business strategies, organizational strategies, and the IT strategies is the premise for IT enabled KM process	IT supported products/services are critical for the IT enabled KM process	Business needs, organizational actions, IT products/services, and KM outcome assessment are the major dimensions of the IT enabled KM process

The study was limited to five case organizations. Given the nature of KM, the organizations that involve KM tended to be middle or larger organizations. Cases are a form of qualitative data, and can be effectively used to formalize a process occurring within the organizations, and, in this case, how the IT enabled KM is implemented. However, case study always involves errors. From this point of view, a method based on the case study always has its limitations. Consequently, the induction model formalized in this paper is subject to variation of individual organizations.

Managerial theories usually originate from business case studies [26]. This case study has made contributions to KM in organizations by illustrating the alignment between the IT and KM process. The findings of this study will be further developed into managerial theories for the KM process. Clearly, future studies are needed to improve and test such theories based on larger samples.

CONCLUDING REMARKS

This paper presents a generalized induction model for process design of the IT enabled KM and examines the major aspects of KM based on five real-life KM cases. It is clear that the competence of KM depends not only on the available technologies, but on the alignment of the business strategy and the KM strategies. The contribution of this study is in the conceptual construction of the KM model that can be used for strategy-driven KM.

This study has primarily focused on business strategies, IT strategies, organizational strategies, IT supported products and services for KM, and assessment for KM. The study has also shown the interaction between these aspects. The model provides a road-map for all parties involved in KM. For enterprises, there is an organizational need to develop overall IT strategies and organizational strategies for KM. For middle management, managing cultural changes, building trust, and initiating reward systems are new tasks for KM beyond routine decision making. For IT teams, it is a great opportunity to use new techniques and tools for KM. Simple databases and blogs may not be sufficient for KM. In our view, sophisticated IT technology for KM is yet to come. For knowledge workers, the key players of KM, new skills of information literacy are required. They must clearly perceive the benefit of KM for themselves. They must understand the structure of the organizational knowledge, and develop the competency of transformation between explicit knowledge and tacit knowledge.

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ACKNOWLEDGEMENTS

The authors thank Jim Curtin, Sarah Lamothe, Gaurav Fernandes, David Rhodes, Andy Yin, Rhonda Baptiste-Nenan, and Jodi Hsu for their invaluable contributions to this study. The second author is supported in part by Grant 312423 from the Natural Sciences and Engineering Research Council of Canada (NSERC).

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