IT for KM in the management consulting industry

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Abstract

Purpose – *The purpose of the paper is to examine the underlying components of information technology (IT) that support different models of knowledge management (KM).*

Design/methodology/approach – *This empirical study is conducted in the management consulting industry to examine the important link between IT and KM. Based on previous research, four knowledge models were developed for the management consulting industry based on the knowledge type and service type. Data collected through a survey from 115 management consulting firms in the USA and Canada were analyzed.*

Findings – *Regardless of the type of KM model utilized, the most widely used IT by management consulting firms was the internet-related technology (e-mail, internet, and search engine). The second important IT component was data management technology (document management, data warehousing, data mining, knowledge repositories, and database management). The third important IT was collaborating technology (videoconferencing, workflow management, groupware, group decision support systems, and knowledge maps). The least important IT was artificial intelligence (expert systems, case-based reasoning systems, intelligent agent, and neural network).*

Originality/value – *This paper develops a new topology of KM models based on the knowledge type (exploitive and explorative) and service type (standardized and customized). Thus, four KM models are developed: reuser (exploitive/standardized); stabilizer (exploitive/customized); explorer (explorative/standardized); and innovator (explorative/customized). While IT has been widely accepted as an enabler for KM, its application for a different focus of KM has not been explored.*

Keywords *Knowledge management, Modelling, Communication technologies, Management consultancy*

Paper type *Research paper*

Introduction

Advances in information and telecommunication technologies (ICT) are enabling organizations to be agile, resilient, and fluid. These organizations seek to create new competencies to gain and sustain competitive advantages in evolving new markets. Highly adaptive network-based enterprises rely on the knowledge and creativity of their human resources to create such competencies. We live in the knowledge age where the only real organizational resource is knowledge, the result of creatively leveraging human expertise and enabling technologies (Drucker, 2002). Thus, intellectual assets have now replaced natural resources as the foundation for competitive advantage and thus managing knowledge is crucial for the organization's success.

Knowledge management (KM) envisions getting the right information within the right context to the right person at the right time for the right business purpose. KM includes the entire cycle of the discovery, creation, storage, dissemination, and utilization of knowledge. Information technology (IT) is the critical resource for supporting KM (Metaxiotis *et al.*, 2005; Edwards *et al.*, 2005). It is technology that has made KM possible and has dramatically reduced costs and increased speed of information and knowledge transmission.

"The choice of KM specialization or approach depends on the type of service that a consulting firm offers to its clients, the economies of its business, and its human capital."

Both practitioners and academic researchers have addressed the issue of IT enabled KM. These studies have mainly focused on individual IT applications. However, to truly take advantage of IT and spend the money wisely in supporting KM processes, it is important for organizations to examine the underlying components of IT that support different models of KM. Since management consulting firms' major product is knowledge, they would be a good source to find out how firms use different IT technologies for different KM models. This paper presents an empirical study of this important link between IT and KM.

KM in the management consulting industry

Management consulting is an industry whose core product is knowledge. Consulting firms sell their expertise and experience to customers. Thus, managing knowledge is the most critical process in the consulting industry. Studies on KM strategies in the management consulting industry (Hansen *et al.*, 1999; Sarvary, 1999; Lai and Chu, 2000; Truch and Bridger, 2002; Kirk, 2003; Fėher, 2004) have indicated that there are two types of KM approaches: centralized/codified and decentralized/personalized.

In the centralized/codified approach, knowledge is codified and stored in the knowledge base of an organization. Then the stored knowledge can be accessed and reused easily by anyone in the organization. The emphasis is on capturing existing knowledge and reusing it. Centralized/codified KM systems can be observed in large IT consulting firms whose KM approach is characterized by a very intensive use of technological solutions; building centralized knowledge base, to support the geographically dispersed employees (Fėher, 2004). Accenture (for its IT consultancy) and the former Big 6 consulting firms are examples of companies employing this approach (Hansen *et al.*, 1999; Sarvary, 1999). Their customers' problems are typically operational. Their service often includes highly standardized solutions for the client. Since operational problems have low context dependence, their solutions can be relatively easy to codify, store, and retrieve in the form of manuals, databases, or knowledge repositories. Therefore, IT has played a critical role in this approach.

In the decentralized/personalized approach, the focus is on creating new knowledge for new problems and new challenges. New knowledge is generated through continuous communication and collaboration among people. These KM systems can be observed in firms such as McKinsey, Bain, or Boston Consulting (Hansen *et al.*, 1999; Sarvary, 1999). Such companies are known for their strategy consultancy. Their customers' problems tend to be unique and their solutions are highly customized and context dependent. Since such knowledge is difficult to codify and standardize, the generalist strategy firms typically put more emphasis on facilitating connections and collaboration among people than on capturing and reusing available solutions.

The choice of KM specialization or approach depends on the type of service that a consulting firm offers to its clients, the economies of its business, and its human capital. By studying KM practices of in consulting companies, computer manufacturing firms, and medical centers, Hansen *et al.* (1999) found that emphasizing a wrong approach or trying to pursue both approaches (codified and personalized) at the same time can quickly undermine a business. They suggest that effective firms need to focus on one of the strategies and use the other in a supporting role. However, Truch and Bridger (2002) found that the combination of the two approaches produced high efficiency. Table I presents a summary of the two KM approaches.

KM model

As discussed earlier, the previous research has identifies two primary factors that determine the specific KM approach in the management consulting industry. One is the service type provided and the other is the knowledge type used.

Table I Summary of knowledge management approaches

	KM approaches	
Characteristics of the company	*Centralized KM systems codification strategy*	*Decentralized KM systems personalization strategy*
Procedure	Procedure-oriented	Expertise-oriented
Product/service	Standardized	Customized
Focus	Capturing, utilizing, and reusing existing knowledge	Exploring and creating new knowledge
Customer problems	Operational	Unique, context-dependent
Type of knowledge used	Explicit knowledge	Tacit knowledge
Type of firm	Large IT consulting	Strategy consulting
Use of IT	Heavy use, data management technologies	Less use, collaboration technologies
Strategy	Operational excellence	Innovative product/service

Sources: Adapted from Fèher (2004), Sarvary (1999) and Hansen *et al.* (1999)

Service type can be customized or standardized. The problem structure that a consulting firm deals with will determine the service type. For example, the customized service tends to deal with a customer's unstructured problem while standardized service tends to deal with more structured problem. Table II summarizes service classifications and their characteristics.

Knowledge type can be exploitive or explorative. The knowledge type is determined by how explicit the knowledge is. By nature, explicit knowledge is exploitive. Exploitive knowledge can be precisely articulated and codified. It may be in the form of mathematical formulas, databases, manuals, or documents. Therefore, exploitive knowledge can be easily transferred to other people. Declarative knowledge (which describes something) and procedural knowledge (which explains how something occurs or is performed) are two examples of exploitive knowledge (Zack, 1999).

On the other hand, explorative knowledge is tacit in nature. Such knowledge is difficult to understand, articulate, codify, and, as a result, transfer. Tacit knowledge is developed from direct experience or interactive conversation. The expert's real expertise tends to be explorative. Causal knowledge (explains why something occurs) is an example of explorative knowledge (Zack, 1999).

Exploitive knowledge can be acquired mostly through a manual or database, but explorative knowledge can be acquired through trial and error (Jordan and Jones, 1997). Exploitive knowledge can be disseminated in the formal and structured ways, but explorative knowledge can be disseminated through more informal ways such as role modeling or daily interaction. In the learning focus, exploitive knowledge tends to be incremental while explorative knowledge tends to be transformational or radical. These are summarized in Table III.

KM model types

In this study, the service type (unique or standardized) and the knowledge type (exploitive or explorative) were combined to classify KM models. Four different types of KM models were proposed: customized service with exploitive knowledge; customized service with explorative knowledge; standardized service with exploitive knowledge; and standardized

Table II Consulting service types

	Standardized service	*Customized service*
Customer problem	Structured	Unstructured
Maturity of processes	Mature	New
Focus	Highly reliable/quality/ fast delivery service	Creative/totally new type of service delivery
Solution	Common to many customers	Unique to each customer
	Repeatable solution	Non-repeatable solution
Concept	How to develop and deliver services	What services to provide

Source: Adapted from Jordan and Jones (1997)

Table III Knowledge types of consulting

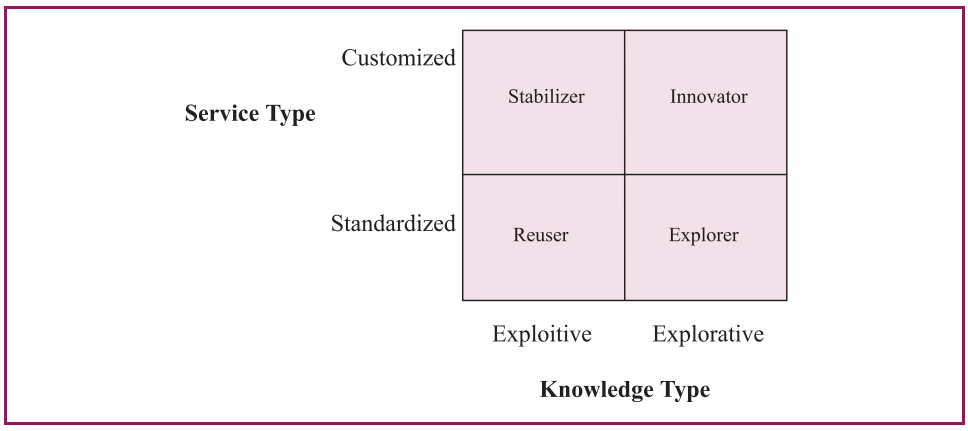
	Exploitive	*Explorative*
Nature of knowledge	Explicit	Tacit
Ease of transfer	Easy	Difficult
Orientation	Procedure-oriented	Expertise-oriented
Examples of knowledge	Declarative, procedural	Causal
Application process	Table look up (in the extreme case)	Trial and error
Training method	Class room	Apprenticeship/coaching
Dissemination process	Formal/prescribed/structured	Informal/role modeling/daily interaction
Learning focus	Incremental	Transformative

Source: Adapted from Jordan and Jones (1997)

service with explorative knowledge. These four distinct models were termed respectively as Stabilizer, Innovator, Reuser, and Explorer (the classification is shown in Figure 1):

1. *Reuser.* The service type of Reuser is characterized as highly standardized. The problems that require this type of service are low context dependent and highly structured. The consulting firms handling such problems repeat the process from one customer to another. The solution for one customer may be applied to another customer. The knowledge type used is characterized as exploitive explicit, and procedure-oriented. This type of knowledge is easy to codify in the databases, manuals, or knowledge repositories. Repeated reuse of existing knowledge is the norm here.
2. *Innovator.* The service type of Innovator is characterized as highly customized. Service requirements of their customers tend to be unique and are highly context dependent. Such problems are usually unstructured. The consulting firms provide highly customized solutions to customers' unique problems. The norm is to provide creative, innovative, and totally new types of services. Therefore, the knowledge type used is characterized as explorative and is tacit in nature and expertise-oriented. Creative thinking and exchange of ideas is a norm in this type of consulting firms. Collaboration among people is crucial.
3. *Explorer.* The service type of Improver is characterized as standardized. The knowledge type used is characterized as explorative. As in the Reuser model, problem solutions can be transferred from one customer to another. However, unlike Reuser, Improver is very aggressive in taking risks. The Improver consulting firm tries to provide customers with unique and innovative solutions. Thus, exploring new types of solutions is very important.
4. *Stabilizer.* The service type of Stabilizer is characterized as customized but the knowledge type used is exploitive. Even though customers' problems tend to be unique and require highly customized solutions as in Innovator, Stabilizer tends to reuse existing knowledge. This type of consulting firm is not aggressive in developing and acquiring

Figure 1 Knowledge management models



new knowledge to solve new and unique problems. Even when it has new types of problems, it still depends on what it has done before (usually stored in knowledge repositories, documents, or databases).

IT for KM

As the importance of organizational knowledge and the role of IT for KM increase, choosing the right IT for different KM strategies is critical. There is a powerful synergistic relationship between KM and IT and that relationship drives increasing returns and sophistication on both fronts (O'Dell and Grayson, 1998; Holsapple, 2005). In the KM context, IT includes a broad range of applications. Some of the IT applications for KM are as follows:

- *Data warehousing*. This is data management technology that integrates information from multiple data sources and makes it easier to explore hidden meaning of data (Chase, 1997; Skyrme, 1999). With a data warehouse, people can access large amounts of information that can be analyzed from different perspectives. This can enhance decision-making quality. When used with appropriate analysis tools (i.e. data mining) or multidimensional data analysis tools (e.g. on-line analytical processing (OLAP)), valuable knowledge can be extracted.
- *Data mining.* This is an emerging technology used to find patterns, trends or relationships in large collections of data and predicts future behaviors from them with the purpose of supporting business decisions.
- *Knowledge mining*. This is a newer form of data mining. Knowledge mining is a process of extracting previously unknown knowledge from a variety of information sources (Hu *et al.*, 1998). Knowledge mining can drastically improve the power of knowledge search by integrating various information sources stored outside of the traditional technology (e.g., relational database). For example, related data and information on the web can be collected using software agent technology such as Web Crawler or Web Spider.
- *Search engines.* These play a key role in making knowledge workers more productive by giving them the information they need in an organized way. By using key words or by using directories, users can retrieve matching information. The information can be ranked or sorted according to certain criteria. By using key words, users can retrieve a great amount of matching results efficiently.
- *Document management systems.* These are repositories of important corporate documents and are therefore important stores of explicit knowledge (Offsey, 1997). Documents give the users knowledge with more context and details. They can include manuals, best practices, policy books, and even drawings.
- *Knowledge creation systems.* These assist thinking and creativity in individuals or in groups. One example is an idea generation tool (e.g., group decision support systems or electronic meeting systems). It can help different creative activities (e.g., concurrent product development) by allowing groups to freely exchange their ideas (Skyrme, 1999).
- *Groupware.* This is a technology that can overcome space and time barriers for group interaction. Its focus is on helping knowledge workers share their expertise, particularly in a physically dispersed environment. It includes software for information sharing, electronic meeting, scheduling, workflow management, and e-mail networks to connect members of the group.
- *Intelligent agents (software agents).* These are a class of software that operates autonomously, intelligently, and knowledgeably (Skyrme, 1999). They are technologies that use a built-in or learned knowledge base to carry out specific, repetitive, and predictable tasks on the behalf of users (Syed, 1998). For example, intelligent agent software can travel over the internet and capture the most appropriate information to the user's preference.
- *Artificial intelligence (AI).* These are technologies such as case-based reasoning systems and expert systems, which are used to manage narrow domains of knowledge. Organizational knowledge can be captured and stored using case-based reasoning systems. In case-based reasoning systems, descriptions of past experiences of human specialists are represented as cases and stored in a case database for a later retrieval.

With the technology, users can input the characteristics of their problem. Then the system searches for stored past cases with similar characteristics and provides a solution. Unsuccessful solutions are solved by human experts and added to the case database with explanations and human solved solutions.

- *Intranets*. In the last few years, intranets have emerged as an important KM tool. They provide several benefits compared with other types of IT applications. Intranets are easy to use and provide universal access to different platforms. At the same time, it allows person-to-person interaction. It can lower the communication cost. Additionally, it prevents outsiders from accessing sensitive information of a company, while linking employees to the outside world. It is widely used to expand an organization's access to information and knowledge.

Research method and results

The authors employed a mail survey method to collect data about how IT is utilized for different KM models by management consulting firms. Data were collected from small and medium-sized management consulting firms in the USA and Canada. The respondents were asked about their service type and knowledge type, and to rank the importance of various popular IT applications used in their KM projects. Based on their answers, companies were classified into one of the four KM models (Figure 1). The authors examined how the responding firms use IT in their business. 1,200 questionnaires were sent by mail to CIOs or the highest ranking IT officers of the consulting companies listed in the *The Directory of Management Consultant*, published by Kennedy Information. A total of 142 questionnaires were returned and 115 complete questionnaires were used for analysis.

Demographic characteristics of respondents

The respondents held various job titles related to IT and KM such as CIO, CEO, MIS manager, and others. Most respondents were CIOs or CEOs. CEOs represented 43.5 percent, while CIOs totaled 36.5 percent of the respondents. The CIO title category includes those who report to CEO such as Chief Information Officer, Vice President of MIS, MIS director, and Chief Technology Officer (CTOs). MIS managers, who report to someone below the CEO, totaled 3.5 percent, and other titles totaled 16.5 percent. The Other Titles category included senior consultant, system analyst, chief operating officer, general office manager, and the like.

The respondents' educational background indicates that the largest category (59 percent) was graduate school degree (including Master, MBA or PhD). The second largest category was college degree with 35.7 percent. These two together took up 94.7 percent. This is an indicator of the knowledge-intensive nature of management consultancy.

Key indicators of company size are the number of employees and revenues. Most responding companies have less than 100 employees (84.4 percent). Only 6.9 percent of the responding companies employ more than 500 people. In terms of revenues, the companies with revenues of less than $100 million occupied 94.8 percent. Only 5.2 percent generate more than $100 million a year in revenues. Both the number of employees and the revenues indicate that the responding companies are relatively small or medium-sized consulting companies (see Table IV).

Classification of KM model

As previously mentioned, the proposed KM model in this study is based on two variables: service type and knowledge type. A total of 13 questions were used to analyze the KM

"Exploitive knowledge can be disseminated in the formal and structured ways, but explorative knowledge can be disseminated through more informal ways such as role modeling or daily interaction."

Table IV Demographics of the research sample

Demographic characteristics	*Percentage*
Job level	
CIO	36.5
CEO	43.5
MIS	3.5
Others	16.5
Educational background	
Graduate	59.0
College	35.7
Number of employees	
Fewer than 100	84.4
More than 500	6.9
Revenue (million)	
Fewer than 100	94.8
More than 100	5.2

approach of the sample firms. Each question is based on a Likert type scale ranging from 1 to 7 (where 1 indicates the least and 7 indicates the most).

Seven items were used to assess the service type. For example, one of the questions was ''how customized is your company's service to the customer's unique situation?'' If the respondent answered 7, then it indicates the company provided totally unique and highly customized service to the customer. If the respondent answered 1, then it indicates that the service provided was very mature and highly standardized. This means that the possible maximum score for service type is 49 (7 items × 7 items). The mean total score for this study was 29.3. Thus, the companies that had a score less than the mean score were classified as ''Standardized,'' while those with greater than the mean score were classified as ''Customized.''

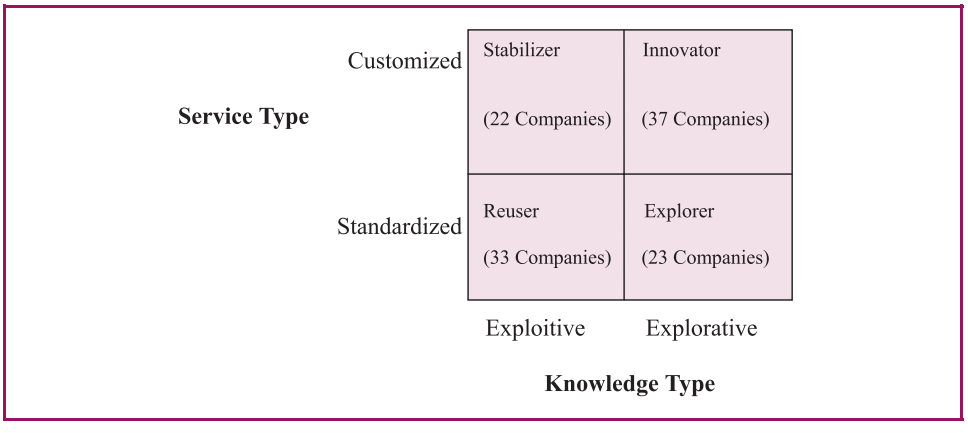
To assess knowledge type, six items were used with a possible maximum score of 42 (6 items × 7 items). The mean total score for service type for this study was 29.2. The companies with less than the mean score were classified as ''Exploitive'' and those with greater than the mean score were classified as ''Explorative.''

Out of the 115 companies in the sample, 22 were classified as Stabilizers, 37 as Innovators, 33 as Reusers, and 23 as Explorers as summarized in Figure 2.

Perceived importance of IT applications in KM

In this part of the questionnaire, the most popular 18 IT applications for KM were identified and listed as shown below:

Figure 2 Sample firms classified by knowledge management models



1. e-mail (EM);
2. search engine (SE);
3. internet (INT);
4. data warehouse (DW);
5. data mining (DM);
6. relational database management systems (RD);
7. object-oriented database management systems (OO);
8. knowledge base/knowledge repository (KB/KR);
9. document management systems (DMS);
10. work flow management systems (WFMS);
11. knowledge map/directory (KM/KD);
12. videoconferencing (VC);
13. group decision support systems (GDSS);
14. groupware (GW);
15. expert systems (ES);
16. case-based reasoning system (CBR);
17. intelligent agents (IA); and
18. neural network (NN).

Respondents were asked to evaluate the perceived importance of each IT application for their KM. Again, a seven-point scale was used for measuring each of IT application where 1 is the least important technology and 7, the most important. For example, one of the questions was ''How important is data warehousing to your KM project?'' 1 indicates that the IT application is the least important to the respondent's company, whereas 7 indicates that data warehousing is critical to the respondent's KM project. Then, based in the above answers on the perceived importance, IT applications for KM projects are ranked and summarized as shown in the above list.

A closer examination of IT applications for KM categorizes them into four groups. The first group is related to the internet technology (e.g., e-mail, search engines, and intranets). The second group is about data management technologies (e.g., relational databases, knowledge repositories, document databases, and object-oriented database management systems). The third group includes collaborating technologies (e.g., group decision support systems, knowledge maps, groupware, or videoconferencing). Finally, the fourth group is related to AI technologies (expert systems, case-based reasoning systems, neural networks, or intelligent agents) as shown in Table V.

Results showed that regardless of the type of KM model, the most widely used IT by the consulting firms in this study were those related to the internet technology. E-mail application was ranked first. The second one was the internet. Search engine was third in all other models (except in Stabilizer).

The second highest group of technologies perceived to be important by consulting firms participated in this study was data management technology. Document management systems, data warehouses, data mining, knowledge repositories/ knowledge bases, and database management systems are major applications of data management technologies.

The third highest important group of technologies was collaborating technologies. Collaborating technologies support joint work of the KM groups and allow cooperative work across physical locations. Videoconferencing, workflow management systems, groupware, group decision support systems, and knowledge maps are major applications of the collaboration technologies.

Table V Summary of the study's perceived importance of IT by classification

Classification	*IT*	*Stabilizer*	*Innovator*	*Reuser*	*Explorer*
Internet technology	EM	1	1	1	1
	INT	2	2	2	2
	SE	6	3	3	3
	Average	*3*	*2*	*2*	*2*
Data management technology	DMS	3	5	10	7
	DW	4	12	8	5
	DM	5	6	5	11
	KB/KR	7	7	4	4
	OO	9	11	11	12
	KM/KD	10	8	6	6
	RD	11	4	7	10
	Average	*7*	*7.6*	*7.3*	*7.9*
Collaborating technology	WFMS	8	9	9	9
	VC	12	12	18	16
	GDSS	14	16	13	14
	GW	16	17	12	8
	Average	*12.5*	*13.5*	*13*	*10.2*
AI technology	ES	13	10	14	15
	CBR	15	14	17	17
	IA	17	15	16	16
	NN	18	18	15	18
	Average	*15.8*	*14.2*	*15.5*	*16.5*

Note: Ranking: 1 = most important; 18 = least important

The least important technology was AI. In the literature, AI technology has been cited as an important tool for capturing expert knowledge or utilizing the best practices or cases of the past. However, this study's sample consulting firms perceived AI technologies as the least important tools for their KM.

Discussion

In this study, it was expected there would be differences in the importance of the various IT applications among KM model firms. For example, in the Reuser model, data management technologies would be more critical than in other KM models because capturing, storing, retrieving and utilizing the existing knowledge comprise the core for this model. On the other hand, these technologies would be more difficult to use for the Innovator model because there is no such knowledge available. The Innovator's strategy is to create new knowledge through creative thinking and interchange of ideas internally or with collaborating partners by using collaborating IT applications. Their customers' problems are usually unique and unstructured. The services provided are supposed to be highly customized and innovative. Knowledge continuously flows between people and IT should provide such support. Expectation was that collaborating technologies and AI would be ranked much more highly in the Innovator model than in other models. However, no such difference was found in this study.

The results of the study were consistent with that of Edwards *et al.* (2005), which was conducted in England. The Edwards *et al.* (2005) study found that, even those organizations that had technology driven KM programs emphasized the use of general information technology tools (e.g., e-mail, shared database, and intranets) rather than tools specific to KM. An interesting fact is that Edwards *et al.*'s (2005) study did not include any knowledge intensive management consultancies firms as opposed to this study that focused only on consulting firms. It is also noteworthy that their findings, as well as authors', were consistent with the findings of Zhou and Fink's (2003) study of Australian organizations.

The result of our study can be explained first from the very nature of the knowledge exchanged in management consulting firms. It is difficult to manage explorative (or tacit) knowledge. Face-to-face communication would be more effective in developing and

"To get the real benefits from IT, KM models and IT capability need to be matched."

communicating tacit knowledge than through IT-based communication. In addition, AI technologies are not yet mature enough to handle the complexity of human knowledge.

IT has been repeatedly cited as one of the critical success factors for KM projects. However, at least in the management consulting industry, more sophisticated and complex IT applications are not being utilized for KM. In addition, there is not much difference in the types of IT used by different KM types of firms. Obviously, there is a gap between literature and actual practice, at least for the sample firms of this study.

Conclusion

As knowledge has become a key success factor in the global economy, organizational KM has drawn attention from management. IT has been generally accepted as a critical enabler for the successful KM implementation. This study classified KM models into four categories based on both, the service type provided and knowledge type used (Figure 1). The intention was to find out if there was and what were the differences in IT applications used by different types of KM models. However, the result of the study showed no distinct patterns of IT applications in different KM models. Most consulting firms still depend on basic IT such as e-mail and search engines. The reason may be because they are simply the most comfortable technologies to use or that they are easy and inexpensive to acquire. However, to get the real benefits from IT, KM models and IT capability need to be matched. Managers need to look for more ways to use IT aggressively according to their KM model.

This study has some limitations. The sample used in this study does not represent the entire management consulting industry. The respondents in this study consisted mostly of small and medium-sized consulting firms. Therefore, the study results have limited implications to large consulting companies. Data from larger firms could have revealed more meaningful insights into the relationship between KM models and IT applications.

Another limitation of this study is that it is based on one assumption: a firm is taking one dominant KM approach. However, some companies are engaged in multiple businesses that are heterogeneous in terms of service type and knowledge type used. When a company is taking multiple KM approaches, the proposed approach in this study may not be applicable.

Finally, the interpretation of this study results is limited to the management consulting industry in the USA and Canada. Other industries and other business in different countries should be studied to generalize the patterns of IT application to KM.

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