Effects of Knowledge Management on Electronic Commerce:
An Exploratory Study in Taiwan

Wen-Jang Kenny Jih, Middle Tennessee State University, USA
Marilyn M. Helms, Dalton State College, USA
Donna Taylor Mayo, Dalton State College, USA

ABSTRACT

The Internet-enabled e-commerce field provides capabilities for firms in all sectors to reach global buyers and suppliers. Knowledge management provides frameworks to manage intellectual capital as a valuable organizational and strategic resource. Current literature on e-commerce and knowledge management primarily emphasizes the benefit of knowledge management for innovative e-commerce operations. Do knowledge management practices significantly benefit electronic commerce? If so, does the relationship work in the other direction? Does a firm's e-commerce applications significantly benefit knowledge management practices, as well? To test these exploratory propositions, empirical data were collected from companies in a variety of industries in Taiwan, a country emphasizing e-commerce initiatives. The results revealed significant relationships between the way businesses implement electronic commerce projects and how they experiment with knowledge management concepts, as well as interesting benefits and difficulties in implementation. These relationships were found to operate in both directions, offering reinforcing effects as well as connections.

Keywords: competitive advantage; electronic commerce; global; information technology; knowledge management

INTRODUCTION

Internationally, Internet technology is an integral component of business strategy. Most firms use electronic commerce to reach customers at home and abroad. E-commerce, when properly linked with business processes and aligned with an organization's culture, aids a firm's strategic growth (Ahadi, 2004; Piris, Fitzgerald & Serrano, 2004). These initiatives can lead to important performance gains

(Green & Ryan, 2005). Another global imperative is the widespread recognition of the value of intellectual capital as a major source of sustainable competitive advantage (Marr, Schiuma & Neely, 2004). To avoid basing competitive strategy on price discounting alone, a company continuously must engage in acquiring and updating the knowledge base. According to Porter (2001), intellectual assets embodied in the total business system are then difficult to duplicate.

Thus, these two developments of knowledge management and e-commerce would seem to supplement each other (Bose & Sugumaran, 2003; Fahey, Srivastava, Sharon & Smith, 2001). Knowledge management provides the mechanism for firms to keep up with innovative activities (Bakhru, 2004; Trethewey & Corman, 2001). As e-commerce information flows freely and sites are easy and inexpensive to duplicate, innovations have an increasingly shorter life span. The integration of major business processes brought about by e-commerce provides a wealth of data and information that can fuel knowledge management (Kocharekar, 2001). Yet, most discussions in the literature are largely conceptual in nature (Holsapple & Singh, 2000).

Inquiries that examine these global issues, based on actual data, are needed to obtain more insight into the relationship and directionality between the two management themes. The purpose of this study is to correct this deficiency in the literature by exploring these relationships. Thus, the primary research question is: Do knowledge management practices signifi-

cantly benefit electronic commerce? If so, does the relationship work in the other direction? Does a firm's e-commerce applications significantly benefit knowledge management practices, as well? To test these exploratory propositions, empirical data were collected from companies in a variety of industries in Taiwan. Taiwan was chosen due to its aggressive emphasis on e-commerce initiatives.

The paper first will briefly review the existing literature on both knowledge management (KM) and electronic commerce (EC) individually and then will present current literature on the linkages or supplementary relationships between the two topic areas. The paper links this literature to the paper's research propositions. Next, the case of Taiwan, a global EC leader, is discussed, along with the questionnaire development and subsequent data collection and analysis. The implications for practice call for future research in other countries in order to validate these exploratory research findings.

LITERATURE REVIEW

Knowledge Management

KM has captured increased attention in today's global business environment, because it views intellectual capital as manageable and suggests frameworks to help companies utilize this valuable strategic resource (Brand, 1998; Child, 2002; Kim & Mauborgne, 1999). KM is a set of business processes through which valuable knowledge is identified, collected/created, organized/stored, distributed, man-

aged, and applied to problems or projects (Child, 2002; Davenport & Prusak, 2000; Grover & Davenport, 2001; Kim & Mauborgne, 1999; Leseure & Brookes, 2004; Pan & Scarbrough, 1998; Zack, 1999a).

Early discussions of KM practices range from a human-oriented to a technology-driven point of view. At one extreme of the continuum is the view of knowledge as completely unmanageable and KM as managing knowledge as human networks (Brand, 1998; Porter, 2001; Savary, 1999; Storck & Hill, 2000). Some researchers, however, view KM as an expansion of traditional data and information management. This latter view suggests a holistic approach (joining social and technological factors) in order to achieve performance expectations (Davenport & Prusak, 2000; Koch, Chae & Guo, 2002; Georgopoulos, Koulouriotis & Emiris, 2004; Soo, Devinney, Midgley, Diakoulakis & Deering, 2002).

Researchers argue that organizational knowledge can be managed without an explicit definition of the knowledge itself. Rather, the focus should be on measuring its business processes (i.e., problem solving and decision making) and the innovative outcomes (Grover & Davenport, 2001; Soo, Devinney, Midgley & Deering, 2002). Various researchers (see Ahn & Chang, 2004; Castanho, 2004; Diakoulakis, Georgopoulou, Koulouriotis & Emiris, 2004; Holsapple & Joshi, 2004; Wang & Ariguzo, 2004) have studied knowledge management and worked toward a better understanding of the topic as well as moved toward model development.

KM is emphasized in the computer information systems community and is continuously gaining interest in industries, enterprises, and government (Ahn & Chang, 2004; Davenport & Prusak, 2000). Data and knowledge are available in various forms, and decision makers combine different types of data and knowledge (Mataxiotis, Ergazakis, Samouilidis & Psarras, 2004; Woods, 2004). While the research cites IT issues, artificial intelligence, and EC, most experts agree that the true goal of KM is to establish a unified, global framework (Stankosky, 2004). Although technology is not a replacement for knowledge, the gap between the two must be bridged (Spiegler, 2003).

There are three major areas of concern characterizing an organization's KM program: (1) the choice of implementation strategy (e.g., system-oriented vs. individual-oriented and top-down vs. bottom-up); (2) the set of objectives expected to be achieved (determined by such factors as top managers' support and involvement, the nature of the industry in which the organization operates, its existing information technology infrastructure, and the organizational culture) (Zack, 1999a, 1999b); and (3) critical successful factors.

Mudambi and Navarra (2004) studied multinational subsidiaries' knowledge flows in the United Kingdom and found support for a more creative role for knowledge intensity. Gerstlberger (2004) studied companies in Upper Austria, Germany, and the Silicon Valley in the U.S. and found that regional innova-

tive systems were important for knowledge sustainability.

Electronic Commerce

E-commerce includes business-to-consumer (B2C), business-to-business (B2B), and internal business via an Intranet (Kalakota & Whinston, 1996a). While the expectation for the commercial value of Internet technologies was widely touted during the end of the last century, the sudden collapse of dot-com companies in the spring of 2000 drove many to the other extreme of the expectation continuum. Recent observations have demonstrated that, when used properly, the Internet can become the technological foundation of an innovative international business strategy. It has been recognized generally that *how* the Internet is incorporated in the value-creating business strategy, rather than the Internet itself, enhances a company's competitive advantage (Barua, Konanna, Whinston & Yin, 2002; Feeny, 2001; Fingar & Aronica, 2001; Garbi, 2002; Jih, 2002; Lee & Whang, 2001; Prusak & Liam, 1998; Wigand, 1997).

The Internet provides companies of all sizes and in all industries with a convenient, affordable communication infrastructure that is not limited by time and distance. Internet transactions include the purchase of information products (i.e., software, CDs, books) to physical products (i.e., automobiles and groceries) (Child, 2002; Feeny, 2001; Turban, Lee, King & Chung, 2000). Internet technologies have enabled innovative companies, such as Tesco, e-Bay, Rosenbluth International, Dell, and Amazon.com, to outperform their competitors. As companies streamline their internal and external business processes, the distinction between the old economy and the new economy continues to fade.

Researchers have analyzed EC business models from many different perspectives and frameworks (Barua, Konanna, Whinston & Yin, 2002; Hogue, 2000; Kalakota & Whinston, 1996b; Mahadevan, 2000; Turban, Lee, King & Chung, 2000). EC has become important to countries around the globe. Salman (2004), for example, studied EC for competitive advantage in developing countries, concentrating on Bangladesh. In their study of e-tourism in Greece, Buhalis and Deimezi (2004) found EC to have a great potential for the country and confirmed how EC has revolutionized the travel industry, in particular.

Linkages between EC and KM

EC supports KM. The way companies implement KM concepts often is facilitated by their capabilities in implementing EC applications. The implementation of their EC applications also can benefit from experience acquired from their KM practices. This reinforcing effect results from the following seven characteristics shared by the two management paradigms. Both (1) use the Internet and their related technologies (Grover & Davenport, 2001); (2) emphasize intangible assets; (3) must be tightly integrated with major business processes; (4) are innovation-minded (Srinivasan, Lilien & Rangaswamy, 2002); (5) lack commonly accepted operational performance indicators and are hard to justify (Soo, Devinney,

Midgley & Deering, 2002); (6) have strategic significance (Davenport & Prusak, 2000; Zack, 1999a, 1999b); and (7) govern EC applications and KM implementations, to a certain degree, by the principle of network economies (Brand, 1998; Pan & Scarbrough, 1998; Savary, 1999).

Specifically, EC supports KM in both technology and content. EC applications must be developed with the foundation of an information architecture. Hogue (2000) identified nine functional components of one such EC process architecture: profiling, personalization, search management, content management, workflow management, collaboration and trading, event notification, catalog management, and payment. It is evident that the functional components for EC applications also play an important role in KM practices, as evidenced by the first six of the nine EC components in the Hogue model. In the KM field, Turban, Aronson, and Liang (2005) emphasize the essential role of information technology in KM implementations. In particular, three categories of information technology are instrumental: knowledge discovery (e.g., data warehousing and data mining), knowledge distribution (e.g., collaborative software), and knowledge application (e.g., expert systems and intelligent agent). Most of these technologies, such as expert system and intelligent agent, have helped EC companies to add a wide variety of customization capabilities to EC applications. The supporting role of EC for KM is evident.

EC applications also support KM practices by providing valuable customer knowledge to help better focus the KM program. Focusing on customer knowledge allows a KM program to be effective in accomplishing its mission and efficient in the use of organizational resources. The importance as well as the dimensions of customer knowledge are addressed by Glosch (2000), Bose and Sugumaran (2003), Jarvenpaa and Todd (1997), and Plessis and Boon (2004). EC Web sites constantly collect a massive amount of customer knowledge through daily operations. These knowledge contents represent valuable resource input for KM programs.

Alvesson (2004) found that key knowledge-intensive firms are using EC in their business models and include IT, management consulting, advertising, and life sciences. He further agrees that KM is, indeed, a core competency. The increased sense of urgency for the institutionalization of comprehensive knowledge management programs is driven by EC. A well-designed KM infrastructure facilitates sharing of knowledge and reduces operating cost, improves staff productivity, and increases the knowledge base and expertise sharing (Bose & Sugumaran, 2003). Spiegler (2003) states that the idea of technology is to represent the means and the knowledge to the end as well as to support the EC process. He agrees that methods for generating knowledge are assisted by using technology or EC.

KM supports EC. Electronic commerce is challenging and is only sustainable for global companies who continue to innovate and strategically use acquired knowledge. Wenger (2004) agrees that if

knowledge is a strategic asset, it must be managed. For example, the value-added content in Web site design has been recognized as an important factor in influencing online shoppers' perceptions as well as their behaviors (Jarvenpaa & Todd, 1997; Wolfinbarger & Gilly, 2002).

True value-added content of an EC Web site only can be produced and sustained through a viable knowledge management program. Huosong, Kuanqu, and Shuqin (2003) agree that, while KM has been studied, our understanding of how the design of a KM system affects both its use and definition is still limited. Malhotra (2000) confirms that knowledge creation is relevant to both e-business and EC.

KM supports EC in various forms. Singh, Furrer, and Ostinelli (2004) studied Web standardization in Italy, India, the Netherlands, Spain, and Switzerland, and found that knowledge of local cultural preferences was important for Web customization. In Brazil, Tigre and Dedrick (2004) studied local cultural knowledge for EC adaptation and found that local forces were important for driving EC diffusion. Plessis and Boon (2004) studied e-business in South Africa and found that knowledge management is a prerequisite for e-business and its increasing customer-centric focus and is an integral part of both customer relationship management and e-business.

Synergy in Both Directions: KM-to-EC and EC-to-KM. Gathering and using customer knowledge and feedback serves to link KM and EC (Blosch,

2000; Bose & Sugumaran, 2003). The potential synergy between KM and EC has been noted in both the information systems and the marketing literature along three dimensions: process impact, community and content, and system architecture (Holsapple & Singh, 2000; Salazar, Hackney & Howells, 2003). The process-impact point of view, in particular, stresses the increasing demand for in-depth knowledge in implementations of e-business processes and views KM as playing a vital role in change management. Fahey, Srivastava, Sharon & Smith (2001) suggest that KM is valuable in evaluating the what, how, and why aspects of e-business operations. Through the development of e-business-focused knowledge, organizations can evaluate the type of work performed in the global e-business environment, understand how they are doing it, and determine why certain practices in companies are likely to change in the future.

In the implementation of a KM solution in Greek banks, Samiotis, Poulymenakou, and Doukidis (2003) found support for KM in the newly employed and strategically important e-banking role, while Bose and Sugumaran (2003) found a U.S. application of KM technology in customer relationship management, particularly for creating, structuring, disseminating, and applying knowledge. Rowley (2002) agrees that such customer knowledge is an important e-business opportunity, since customers in the digital economy depend on knowledge management and the accompanying

organization's knowledge management paradigm.

Recent developments in information technology — the Internet, enterprise resources planning systems, and KM — are all necessary for business survival (Soliman & Youssef, 2001). However, the new business models created by e-business are changing operations. But most agree that it has not been integrated well with internal knowledge management initiatives. Fahey, Srivastava, Sharon, and Smith (2001) stress that, with the development of e-business, focused knowledge organizations are needed to enhance customer relationship management, supply chain management, and product development. The authors also emphasize the central role of knowledge management in managing e-business changes occurring in organizations. Warkentin, Bapna, and Sugumaran (2001) studied e-knowledge networks and found them key in inter-organizational collaborative e-business, thus linking KM and EC.

KM plays a role in customer retention with value-added service through product-related knowledge and support of the online community. Faced with a great array of vendor choices, customers often are attracted by the Web sites that contain relevant, well-organized information and knowledge relating to product quality and usage. The rich knowledge information and knowledge content, according to Wolfinbarger and Gilly (2001), represents an important motivating factor by providing online shoppers with freedom, control, and even fun. Williams and Cothrel (2000) argue for the importance of the online community in the Internet-centered business world and highlight the important role of experience sharing in managing the online community. Finally, on the system architectural dimension, Kocharekar (2001) contends that both KM and EC represent the next movement beyond ERP systems and must converge to a commerce characterized by knowledge-intensive activities, which they term *knowledge commerce* or *K-Commerce*.

Based on our literature review on KM and EC and their initial linkages, we propose that:

EC facilitates the practices of KM, whereas KM guides and supports EC.

The reasoning behind this proposition is reiterated as follows. Although experience suggests that traditional wisdom should not be ignored in running EC businesses, there is also an abundance of evidence indicating that innovative thinking is critical to conducting business via the Internet. Facing a massive amount of information, customers' attentions will be drawn to the Web sites that offer innovative values. KM supports EC by enabling a company to put its entire organizational knowledge base behind such major business processes as new product development, customer service, and supply chain management. The infrastructure constructed for EC applications also provides valuable mechanisms for the implementation of KM programs.

The literature also shows that successful EC operations must be guided and

aligned with business strategy, backed by fully integrated business processes and work flows, and built around a consistent customer-centric system of interactions. This requires a great deal of innovative capability and learning capacity, which only can be achieved with an effective, ongoing knowledge management program. The characteristics shared by EC and KM suggest existence of synergy between the two fields. To test this linkage, we chose to examine the relationship between the two fields in terms of the basic aspects of each, considering B2B and B2C EC applications as well as strategy, objectives, and critical success factors. Thus, the following research propositions were developed:

P1:   EC applications do not significantly affect KM practices.
P1.1: EC applications do not significantly affect the choice of KM implementation strategies.
P1.2: EC applications do not significantly affect the objectives of KM initiatives.

P2:   KM practices do not significantly affect the applications of EC.
P2.1: The choice of KM implementation strategy does not significantly affect applications of EC.
H2.2: Critical success factors of KM initiatives do not significantly affect applications of EC.

RESEARCH METHODOLOGY

The first step to validate our research proposition regarding the mutually rein-

forcing effect between KM and EC is to test the correlation between the two. For this purpose, a cross-sectional survey was administered to business managers.

Taiwan. Taiwan was selected as the site for this exploratory study for several important reasons. Among other major initiatives, EC has been designated by the government of Taiwan as an important area of investment to stimulate national economic vitality and to enhance competitiveness. In the second quarter of 1999, the Ministry of Economic Affairs launched a multi-year project to promote EC applications in 40 industries identified as having the best potential to stimulate long-term national economic development (http://www.ec.org.tw). A primary project objective is to develop Taiwan into an Asia-Pacific regional commercial center. Both B2C and B2B EC applications are included in the promotional campaign. These government-funded promotions include research support, training, systems development, and a national innovative projects contest. In academia, a variety of research projects have been sponsored by the National Science Council, and numerous industrial associations in Taiwan examine various aspects of EC applications. Based on a field survey, Jih (2002) found that a variety of benefits has been realized by companies in Taiwan who have actively adopted EC.

Taiwan recovered more quickly than other Asian nations from the 1997-1998 financial crises that hit Asian markets and experienced only a brief period of slow growth. Currently, Taiwan has a solid eco-

nomic and financial foundation due to its economic transformation from a labor-intensive environment to a capital and technology-intensive environment. This export-oriented economy has grown at a 5% to 6% yearly rate, and this growth, in part, is due to the continuous development of a knowledge-based economy (Tang, 2000; Wang, Scherban & Bonnici, 2005). Taiwan now exports twice as much to China as to the U.S. after decades of relying only on the American market, largely due to their increase in the production of computer chips, laptop computers, and notebooks (Bradsher, 2004).

Recognizing the importance of continuous innovation in such major areas as new product development, production process streamlining, and quality assurance, many Taiwanese companies have attempted to implement forms of KM programs in their organizations. Many manufacturing firms in Taiwan play an important upstream role in global supply chains. These companies understand that they must continually improve their production cost, quality, delivery, and service. The service industries within the domestic Taiwanese market also face competition from global players with scale advantages (Child, 2002). World Trade Organization membership means that almost every company in Taiwan will face unprecedented, larger competitors. Taiwan, a small island nation, is a major exporter with little domestic demand. Thus, EC levels the playing field for the nation. Its commerce must be with international partners, and most of these transactions depend on EC as their means of competition.

Survey Instrument. The questionnaire was written in Chinese and contained items designed to address issues related to EC applications, KM practices, the benefits realized, and the difficulties experienced in applying the concepts. The questionnaire was pilot-tested with a convenience sample of managers to ensure validity and reliability. Some questions were revised for clarity and wording, based on the feedback obtained from the pilot test; the companies involved in the pilot testing were excluded from the final results. The data were collected in 2002 and 2003.

In designing the questionnaire, the EC applications in three categories (business-to-business, business-to-consumer, and intra-organizational EC activities) were considered, following the original definition of Kalakota and Whinston (1996b). The following three macro-level aspects of KM practices also were used in the study: KM strategies, KM objectives, and KM critical success factors. Each construct was measured with multiple questions. Except for questions about the respondents' demographic background and company information, all questions used a 7-point Likert-type scale to collect perceptual data, with 7 representing "strongly agree" and 1 representing "strongly disagree." Figure 1 is a graphical depiction of the research proposition and the study's conceptual framework. The EC and KM components, which serve as the basis for the survey items, are summarized in Table 1. The questionnaire consisted of four questions for B2B applications, five questions for B2C applications,
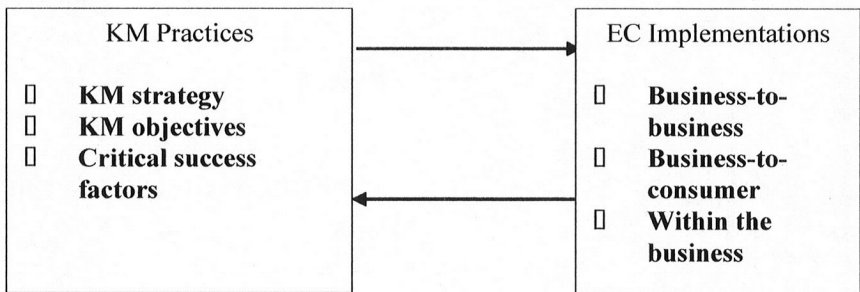
Figure 1. Conceptual framework

Table 1. Summary of research variables

	Research Variables	Definition
EC Activities	Business-to-Business EC Activities	• Electronic financial transaction • Knowledge dissemination and sharing • Workgroup discussion • Workflow integration
	Business-to-Consumer EC Activities	• Organizational information dissemination • Online transaction • Product/Service information inquiry • Customer service • Online advertising
	Intra-organizational EC Activities	• Information dissemination and sharing • Workgroup discussion • Workflow integration
KM Activities	KM Strategies	• Systems approach vs. Individual approach • Top-down vs. bottom-up approach
	KM Objectives	• Increasing organizational knowledge repository and value • Establishing knowledge network • Improving efficiency of knowledge usage • Facilitating organizational innovation • Promoting organizational learning
	Critical Success Factors for KM	• Linkage with overall organizational performance • Technological and organizational infrastructure • Flexible knowledge organization structure • Organizational culture enables knowledge sharing • Clear and specific objectives • Incentive measures • Multiple knowledge transfer channels • Top management support

Table 2. Sample survey items (All on a 7-point Likert-type scale with 1 *as* Strongly Disagree *to* 7 *as* Strongly Agree*)*

EC (B2B)
- Our financial transactions with upstream and downstream business partners are all conducted on WWW and/or EDI.
- We exchange information, knowledge, and experience with business partners on WWW and/or EDI.
- We use WWW and/or EDI to communicate and collaborate with our business partners.
- We use computer networks, including the Internet, to integrate our workflows with business partners.

EC (B2C)
- We provide company and products/ services information on our Web site.
- We conduct product and service transactions online.
- We provide online search capability for customers' information inquiries.
- We offer online customer service and inquiry capabilities.
- We advertise and promote our products and service online.

EC (Intranet)
- We encourage knowledge and experience sharing among employees using computer networks.
- We provide networking capabilities for employees to communicate with one another and to engage in group discussions.
- We attempt to integrate our workflows using Internet technologies.

KM Strategy
- Please indicate the relative emphasis on the two knowledge management strategies of your company:
  System-driven: _____ %
  Personally oriented: _____ %
  (Please note: The two numbers should total 100 %.)
- Please indicate the relative emphasis on the following two knowledge management strategies of your company:
  Top-down strategy: _____ %
  Bottom-up strategy: _____ %
  (Please note: The two numbers should total 100 %.)

KM Objectives
- Our objective for knowledge management implementation is to create electronic databases, digital knowledge bases, document bases, and other digital media, so they can be accessed conveniently by our employees.
- Our objective for knowledge management implementation is creating valuable knowledge repositories in electronic forms.
- Our objective for knowledge management implementation is to strengthen our innovation.
- Our objective for knowledge management implementation is to uncover knowledge owned by our employees so it can be utilized more.

KM Critical Success Factors

Table 3. Sample distribution

	Financial Service Institutions	Information Technology Industry	Electronics Manufacturing Industry	Other Industries	Total
Questionnaires Mailed	102	19	50	50	221
Questionnaires Received	37	13	17	11	78
Effective Questionnaires	31	10	14	8	63
Effective Questionnaire Return Rate	30.4%	52.6%	28%	16%	28.5%

and three questions for intranet applications. For KM implementation practices, there were two questions on KM strategies, 13 on KM objectives, and 10 on KM critical success factors. In addition, 15 benefits questions and 11 difficulty items were included to advance understanding of KM implementations.

For KM strategies, companies were asked to identify the relative emphasis (as a percentage) of system-oriented (technology view) vs. personal-oriented (human resource view) and top-down (revolution approach) vs. bottom-up (evolution approach) KM implementation strategies. Examples of survey questions are included in Table 2.

Data Collection and Analysis

A total of 221 questionnaires were mailed to the chief information officers of a variety of companies in Taiwan. The companies were selected, based on their publicly reported EC and KM activities and their positions as recognized leaders in the application of EC and KM concepts within key industries in Taiwan. They were categorized into financial service institutions, information technology, electronics manufacturing, and other industries (representing pharmaceutical, management consulting, and retail chains). Sixty-three questionnaires were returned, representing an effective response rate of 28.5%. Information technology representatives had the highest response rate (52.6%) — an understandable result, given the progressive nature of this industry in Taiwan. A follow-up interview was conducted with a small number of these companies to obtain anecdotal and supplementary information to augment the quantitative data. The distribution of the respondents is summarized in Table 3.

Statistical analysis was used to analyze the collected data. First, descriptive statistics were obtained for each variable. The correlation between EC applications and KM objectives and between EC applications and KM critical success factors then were analyzed using Pearson Product-Moment Correlations. A one-way analysis of variance was conducted to examine the impact of KM implementation strategy on EC applications and the difference of KM implementation strategies among different industries. In addition, the

Table 4. Reliability measures of the research constructs and the questionnaire

	Cronbach's α	Question Category	Number of Questions	Cronbach's α
E-Commerce	0.94	B-B EC	4	0.8682
		B-C EC	5	0.9775
		Intranet	3	0.9380
Knowledge Management	0.9792	KM Objectives	13	0.9832
		KM CSF	10	0.9762
		Current Implementations	26	0.9592
Entire Questionnaire		0.9795		

internal consistency of the questionnaire (measured by the Cronbach's alpha coefficient) was examined to ensure survey reliability. Table 4 shows each individual construct has a Cronbach's α coefficient of at least 0.8682, and Cronbach's alpha for the entire questionnaire is 0.9795. The questions for perceived benefits from KM implementations and for the difficulties encountered also were analyzed. Cronbach's alpha for the former is 0.9827, and the latter is 0.9204, both indicating high degrees of reliability.

SURVEY RESULTS

Since the effective respondents all had EC and KM programs, the distribution of their sizes (as measured by the number of employees and annual sales) was examined to determine if size had a significant influence. Although there were 23 companies (36.5%) with 1,000 or more employees, there were also 28 companies (44.4%) with 300 or fewer employees. The largest revenue category was represented by 19 responding companies with annual sales of $800 million USD or more. The second category was repre-

sented by the companies with annual sales between $40 million and $134 million USD. Although larger companies had more resource support for applications of EC and KM, smaller companies also were actively engaged in these activities. In fact, follow-up interviews revealed that smaller companies hoped EC and KM applications would help them compete more effectively within their respective industries.

Effects of EC Applications on KM Practices

The possible effects of EC applications on KM strategies were examined by obtaining the Pearson product-moment correlation coefficient between EC applications and KM practices. Each EC application type was used as an independent variable, and each knowledge strategy type as a dependent variable. As summarized in Table 5, the system's approach is positively correlated, and the individual approach is negatively correlated with B2B EC applications. The fact that these are the only significant correlation coefficients (at the 1% level) may be explained by the experimental nature of EC (especially

Table 5. Correlations between EC implementations and KM strategies

	B2B EC	B2C EC	Intranets
Systems Approach	0.461*	0.121	0.178
Individual Approach	-0.461*	-0.121	-0.178
Top-down Approach	-0.101	-0.126	-0.018
Bottom-up Approach	0.101	0.126	0.018

* Level of significance < 0.01

Table 6. Correlations between EC implementations and KM objectives

	B2B EC	B2C EC	Intranets
Increasing organizational knowledge and value	0.448*	0.669*	0.668*
Establishing knowledge network	0.427*	0.607*	0.578*
Improving efficiency of knowledge usage	0.428*	0.697*	0.617*
Facilitating organizational innovation	0.458*	0.710*	0.676*
Promoting organizational learning	0.383*	0.690*	0.675*

* Level of significance < 0.01

B2C EC) and KM activities. The system's approach places more emphasis on the use of information technology in implementing KM projects, whereas the individual approach views human interaction as the more important information technology. Both the degree and the direction of the correlation coefficients indicate that key aspects of EC applications and KM implementation strategies (system vs. individual) are significantly correlated.

When EC activities are correlated with KM implementation objectives, the correlation coefficients are significant at the 1% level (See Table 6). The degrees of EC implementations are positively correlated with the importance placed on each KM objective. It appears that these companies have an understanding of the strategic value of KM to their organizations and an expectation that EC applications will facilitate successful implementations of KM. In summary, some EC applications

do facilitate KM practices. Therefore, Proposition 1 is rejected.

The data from Taiwan about the effects of EC applications on KM practices indicate that KM practices benefit from EC application. This facilitating effect is especially obvious in fulfilling KM objectives — all EC application types have a significantly positive impact on both the efficiency and effectiveness of KM programs. The technological infrastructure and business processes designed for EC operations, such as the Web-based user interface, product/service customization, and online community, also facilitate important aspects of knowledge management (e.g., knowledge acquisition, knowledge flow, and knowledge application. The facilitation effect is discussed by Alvesson (2004) and Rowley (2002). Buhalis and Deimezi (2004) also reported similar findings in their study about the travel industry in Greece. Kankanhalli, Tanudidjaja,

Table 7. Correlation between CSFs for KM and EC applications

	B2B EC	B2C EC	Intranets
Linkage with overall organizational performance	0.364**	0.563**	0.579**
Technological and organizational infrastructure	0.275*	0.420**	0.503**
Flexible KM organization structure	0.377**	0.494**	0.622**
Organizational culture enables knowledge sharing	0.283*	0.465**	0.525**
Clear and specific objectives	0.318*	0.559**	0.584**
Incentive measures	0.2 37	0.446**	0.460**
Multiple knowledge transfer channels	0.326**	0.536**	0.551**
Top management support	0.347**	0.685**	0.598**

* Level of significance < 0.05; ** Level of significance < 0.01

Sutanto, and Tan (2003) shared this observation by attributing part of the KM program's implementation success at British petroleum, Buckman Laboratories, and Shell to the capabilities of their EC-enabled information technologies. As a matter of fact, the majority of technological tools discussed in the KM literature are associated with some types of EC applications (Holsapple, 2004). Although successful KM implementation does not depend solely on EC technology, the technological tool is essential in order to smoothly implement the KM program.

Effects of KM Practices on EC Applications

A one-way analysis of variance (ANOVA analysis) was used to determine the effects of KM practices on EC applications using each EC application as the dependent variable and KM strategies as the independent variables. The B2B EC is the only variable affected significantly by the choice of systems approach vs. individual approach to KM implementation (F-value: 9.257, level of significance < 1%). Thus, the choice of KM implementation strategy does significantly affect some aspect of EC application; namely, B2B EC.

When each type of EC application was used as the dependent variable with critical success factors for KM implementation as the independent variables, the result of Pearson Product-Moment Correlation analysis shows that all correlation coefficients pass the test at either the 1% or 5% level of significance. The highest correlation relationship is found between Intranets and flexible KM organization structures. Thus, the more flexible the organization structure for KM, the more likely that company-owned Intranets would be utilized. It is also worth noting that the degree of Intranet usage has higher

Table 8. Benefits realized from KM initiatives

Rank	Benefit from KM Initiatives	Mean	Standard Deviation
1	Improvement of organizational capability in responding to environmental change	4.92	1.35
2	Improvement of overall productivity	4.90	1.52
3	Improvement of overall performance	4.86	1.62
4	Timely monitoring of competition situations	4.83	1.62
5	Enhancement of organizational innovative capability	4.81	1.48
5	Enhancement of customer satisfaction	4.81	1.62
6	Quicker response to market demand variation through production adjustment or marketing planning change	4.79	1.60
7	Improvement of product quality	4.78	1.53
8	Improvement of relationship with suppliers and customers	4.75	1.44
9	Improvement of employee satisfaction	4.73	1.61
10	Increase of sales volumes	4.63	1.37
11	Reduction of operational costs	4.51	1.53
11	Increase of profitability	4.51	1.51
12	Reduction of maintenance costs	4.41	1.42
13	Reduction of product/service development costs	4.38	1.56

correlations (with all but one KM variable) than the other two types of EC applications (B2B and B2C). This is an understandable phenomenon, given the current similar internal orientation of both intranet and KM applications. The second component of Proposition 2 (H2.2: Critical successful factors of KM initiatives do not significantly affect applications of EC) is rejected.

EC is emerging rapidly as a competitive paradigm in today's globalized business environment. The companies in Taiwan understand this trend and actively engage in integrating EC in their business models. The key to succeeding in EC applications is to provide attractive customer value (effectiveness) at affordable cost (efficiency). Both effectiveness and efficiency of EC applications can be enhanced by KM. This finding is shared by Singh, Furrer, and Ostinelli (2004) in their report on Web standardization in several European nations, by Tigre and Dedrick (2004) in their study regarding using local cultural knowledge for EC adaptation in Brazil, and by Plessis and Boon (2004) in the study in South Africa. In addition, stories abound in Fortune 500 companies about how innovative EC applications derive enormous business value from aggressive KM implementation (Holsapple, 2004).

Perceived Benefits from KM Implementations

Qualitative understanding of the future of KM in Taiwan was addressed by 15 items in the questionnaire. The means and the standard deviations, as well as the rankings, are summarized in Table 8. The top five benefit items are (1) improvement of organizational capability in responding to environmental change; (2) improvement of overall productivity; (3) improvement

Table 9. Difficulties experienced in KM implementations

Rank	Difficulties Encountered	Mean	Standard Deviation
1	Difficulty in knowledge flow due to lack of inter-departmental coordination	4.62	1.47
2	Lack of top management support	4.44	1.64
3	Weak consensus on the value of knowledge to the organization	4.33	1.51
4	Lack of innovative capability and motivation to innovate	4.30	1.53
5	Lack of incentive to encourage knowledge sharing	4.16	1.45
6	Lack of clearly defined communication mechanisms across departments	4.11	1.48
7	Employee resistance to sharing knowledge	3.94	1.60
8	Lack of clearly defined objectives for KM	3.92	1.51
9	Lack of trust between employee and management	3.76	1.51
10	Lack of hardware equipment to implement KM projects	3.49	1.74
11	Lack of proper software to implement KM projects	3.46	1.68

of overall performance; (4) timely monitoring of competition; and (5) enhancement of organizational innovative capability. It is interesting to note the breadth of the top 10 benefit items: capability to respond to change; productivity and performance improvement; relationship improvement (customer, supplier, and employee); and product quality improvement. Companies appear to have a good understanding that successful KM requires a broad view of value assessment. This is a sound beginning, since it requires an extensive period of time for a company to reap the long-term benefits from a KM investment. These findings are consistent with those reported in the KM literature.

PERCEIVED DIFFICULTIES ENCOUNTERED IN KM IMPLEMENTATIONS

On a 7-point Likert-type scale, the six difficulty items with difficulty averages above 4, as reported by respondents are (1) difficulty in knowledge flow due to lack of interdepartmental coordination; (2) lack of top management support; (3) weak consensus on the value of knowledge to the organization; (4) lack of innovative capability and motivation to innovate; (5) lack of incentive to encourage knowledge sharing; and (6) lack of clearly defined communication mechanisms across departments. Organizational and human factors ranked higher than technological factors, a confirmation of the observation reported in KM literature about the importance of organization culture for KM implementation (Brand, 1998; Davenport & Prusak, 2000; Koch, Paradice, Chae & Guo, 2002; Pan & Scarbrough, 1998; Storck & Hill, 2000). The finding suggests that, while companies have a clear understanding of the strategic value of knowledge, it is difficult for them to develop momentum. Nonetheless, the fact that the highest degree of difficulty is only 4.62 indicates that companies do not feel hopeless about coping with these challenges.

SUMMARY AND CONCLUSION

The business environment today requires companies to continually offer new and improved products or services, trim operational costs, shorten delivery time, increase quality, provide value-added customer services, and quickly adapt to unexpected changes. To cope effectively with these multi-faceted challenges, companies must engage diligently in activities that are capable of transforming their businesses into intelligent-acting organizations (Wiig, 1994, 1995). EC represents a promising avenue by enabling companies to interact directly with customers and integrate efforts of supply chain members (Keeny, 1999). The improved innovative capacity resulting from a thorough execution of KM strategies helps companies to establish and sustain competitive advantage by providing unique, attractive customer values (Zack, 1999a, 1999b).

The literature reviewed suggests that there is a significant relationship between how companies apply EC and how they practice KM in their operations. Our empirical study confirms this proposition. More specifically, the choice between systems-oriented and individual-oriented KM implementation strategies is affected by the B2B EC and vice versa. Each of the of KM implementation objectives is significantly affected by each of the three types of EC applications, and each of the three types of EC applications is significantly affected by all but one KM critical success factor.

Two important implications for information systems professionals and EC managers can be drawn from the findings of this study. First, although information technology does not guarantee success of either EC applications or KM implementations, it does represent an essential component, since it provides the technological infrastructure. The information technology infrastructure must be aligned properly with business strategy and business processes in order to create synergies. Only with a high degree of synchronized efforts can a company perform competitively in an open environment. Taiwan is not unique in the pressures for global expansion and increased need for market development. Taiwan's recent success in manufacturing computer-related hardware and software is a natural fit to the need for EC applications and KM implementations.

Second, the investments in EC applications and KM implementations are complementary. As noted in the Taiwanese example, the hardware and software tools acquired for EC applications can be useful for the promotion of KM activities. EC applications are guided and supported by an active KM program. The companies in Taiwan, as demonstrated in this study, are similar to companies in other parts of the world with regard to the facilitation effect of EC on KM. The enabling and support effect of KM on EC and the synergistic effect between EC and KM in Taiwan also are evident in companies throughout the world. These findings add to and extend the EC and KM research by providing empirical evidence obtained in Taiwan.

The contributions of this study are largely exploratory. It is the first study to attempt to empirically test the directional linkage or correlation between KM and EC. Other literature has alluded to the relationship but has not attempted to validate its presence. Since the subjects for this research were Taiwanese businesses operating in a global business environment, the study has global relevance. However, it is limited to one country. Other limitations of the research are the questionnaire design, which was limited to subjective judgment, and variable response rates. Future research should work to overcome these limitations.

Three directions for future research are suggested. The first direction extends the scope of coverage by including additional forms of EC application (such as customer-to-business) and other KM practice items (e.g., knowledge acquisition methods). The second direction should examine in-depth relationships between EC and KM. For example, an interesting research issue might be how communities of practice support EC operations. The third direction involves collecting primary data from companies in the U.S. and internationally in order to further validate the research propositions, explore additional relationships, make cross-cultural comparisons, and establish further global linkages between these two important management themes.

REFERENCES

Ahadi, H.R. (2004). An examination of the role of organizational enablers in business process reengineering and the impact of information technology. *Information Resources Management Journal, 17*(4), 1-19.

Ahn, J-H. & Chang, S-G. (2004). Assessing the contribution of knowledge to business performance: The KP3 methodology. *Decision Support Systems, 36*(4), 403-414.

Alvesson, M. (2004). *Knowledge work and knowledge-intensive firms*. Oxford: Oxford University Press.

Bakhru, A. (2004). Managerial knowledge to organizational capability: New e-commerce businesses. *Journal of Intellectual Capital, 5*(2), 326-336.

Barua, A, Konana, P.K., Whinston, A.B., & Yin, F. (2001). Managing e-business transformation: Opportunities and value assessment. *Sloan Management Review, 43*(1), 36-44.

Blosch, M. (2000). Customer knowledge. *Knowledge and Process Management, 7*(4), 265-268.

Bose, R. & Sugumaran, V. (2003). Application of knowledge management technology in customer relationship management. *Knowledge and Process Management, 10*(1), 3-17.

Bradsher, K. (2004, December 13). Taiwan watches its economy slip to China. *New York Times*, p. C7.

Brand, A. (1998). KM and innovation at 3M. *Journal of KM, 2*(1), 17-22.

Buhalis, D. & Deimezi, O. (2004). E-tourism developments in Greece: Information communication technologies adoption for the strategic management of the Greek tourism industry. *Tourism and Hospitality Research, 5*(2), 103-130.

Castanho, M.A.R.B. (2004). What do college life sciences students need to know about knowledge management. *Journal of Biological Education, 38*(2), 85-89.

Child, P.N. (2002). Taking Tesco global. *The McKinsey Quarterly, 3.*

Davenport, T.H. & Prusak, L. (2000). *Working knowledge: How organizations know what they know.* Boston: Harvard Business School Press.

Diakoulakis, I.E., Georgopoulos, N.B., Koulouriotis, D.E., & Emiris, D.M. (2004). Towards a holistic knowledge management model. *Journal of Knowledge Management, 8*(1), 32-46.

Fahey, L., Srivastava, R., Sharon, J.S., & Smith, D.E. (2001). Linking e-business and operating processes: The role of knowledge management. *IBM Systems Journal, 40*(4), 889-907.

Feeny, A. (2001). Making business sense of the e-opportunity. *Sloan Management Review, 42*(2), 41-51.

Fingar, P. & Aronica, R. (2001). *The death of E and the birth of the real new economy.* Tampa, FL: Meghan-Kiffer Press.

Garbi, E. (2002). Alternative measures of performance for e-companies: A comparison of approaches. *Journal of Business Strategies, 19*(1), 1-17.

Gerstlberger, W. (2004). Regional innovation systems and sustainability: Selected examples of international discussion. *Technovation, 24*(9), 749-758.

Green, A. & Ryan, J.J.C.H. (2005). A framework of intangible valuation areas (FIVA): Aligning business strategy and intangible assets. *Journal of Intellectual Capital, 6*(1), 43-53.

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

Hoffman, D.L. & Novak, T.P. (1997). A new marketing paradigm for EC. *The Information Society, 13*, 43-54.

Hogue, F. (2000). *E-enterprise: Business models, architecture, and components.* Cambridge, MA: University Press.

Holsapple, C.W. (Ed.). (2004). *Handbook of knowledge management.* Berlin: Heiderberg-Springer.

Holsapple, C.W. & Joshi, K.W. (2004). A formal knowledge management ontology: Conduct, activities, resources and influences. *Journal of the American Society for Information Science and Technology, 55*(7), 593-605.

Holsapple, C.W. & Singh, M. (2000). Toward a unified view of electronic commerce, electronic business, and collaborative commerce: A knowledge management approach. *Knowledge and Process Management, 7*(3), 151-164.

Huosong, X, Kuanqi, D., & Shuqin, C. (2003). Enterprise knowledge tree model and factors of KMS based on E-C. *Journal of Knowledge Management, 7*(1), 96-106.

Jarvenpaa, S.L. & Todd, P.A. (1997). Consumer reactions to electronic shopping on the World Wide Web. *International Journal of Electronic Commerce, 1*(2), 59-88.

Jih, W.J.K. (2002). Effects of EC implementations in Taiwan. *Journal of Computer Information Systems*, 56-62.

Kalakota, R. & Whinston, A.B. (1996a). *Electronic commerce: A manager's guide*. New York: Addison-Wesley.

Kalakota, R. & Whinston, A.B. (1996b). *Frontiers of EC*. New York: Addison-Wesley.

Kankanhalli, A., Tanudidjaja, F., Sutanto, J., & Tan, B.C.Y. (2003). The role of IT in a successful knowledge management initiatives. *Communication of the ACM, 46*(9), 69-73.

Keeny, R.L. (1999). The value of Internet commerce to the customer. *Management Science, 45*(4), 533-542.

Kim W.C. & Mauborgne, R. (1999). Strategy, value innovation, and the knowledge economy. *Sloan Management Review, 40*(3), 41-54.

Koch, H., Paradice, D., Chae, B., & Guo, Y. (2002). An investigation of KM within a university IT group. *Information Resources Management Journal, 15*(1), 13-21.

Kocharekar, R. (2001). K-commerce: Knowledge-based commerce architecture with convergence of e-commerce and knowledge management. *Information Systems Management*, 30-35.

Lee, H.L. & Whang, S. (2001). Winning the last mile of e-commerce. *Sloan Management Review, 42*(4), 54-62.

Leseure, M.J. & Brookes, N.J. (2004). Knowledge management benchmarks for project management. *Journal of Knowledge Management, 8*(1), 103-116.

Mahadevan, B. (2000). Business models for Internet-based e-commerce: An anatomy. *California Management Review, 42*(4), 55-69.

Malhotra, Y. (2000). Knowledge management for e-business performance: Advancing information strategy to "Internet time" information strategy. *The Executive's Journal, 16*(4), 5-16.

Marr, B., Schiuma, G, & Nelly, A. (2004). Intelectual capital: Defining key performance indicators for organizational knowledge assets. *Business Process Management Journal, 10*(5), 551-569.

Mataxiotis, K., Ergazakis, K., Samouilidis, E., & Pgarras, J. (2004). Decision support through knowledge management: The role of the artificial intelligence. *International Journal of Computer Applications in Technology, 19*(2), 101-119.

Mudambi, R. & Navarra, P. (2004). Is knowledge power? Knowledge flows, subsidiary power and rent-seeking within MNCs. *Journal of International Business Studies, 35*(5), 385-406.

Pan, S.L. & Scarbrough, H. (1998). A socio-technical view of knowledge-sharing at Buckman Laboratories. *Journal of KM, 2*(1), 55-66.

Plessis, M. & Boon, J.A. (2004). Knowledge management in e-business and customer relationship management: South Africa case study findings. *International Journal of Information Management, 24*(10, 73-85.

Piris, L. Fitzgerald, A.S. (2004). Strategic motivators and expected benefits from e-commerce in traditional organizations. *International Journal of Information Management, 24*(6), 489-499.

Porter, M. (2001). Strategy and the Internet. *Harvard Business Review*,

63-78.

Prusak, L. & Liam, F. (1998). The eleven deadliest sins of KM. *California Management Review, 40,* 265-276.

Rahman, B. (2004). Knowledge management initiatives: Exploratory study in Malaysia. *Journal of the American Academy of Business, 4*(1/2), 300-335.

Rowley, J.E. (2002). Reflections on customer knowledge management in e-business. *Qualitative Market Research, 5*(4), 268-280.

Salazar, A., Hackney, R, & Howells, J. (2003). The strategic impact of Internet technology in biotechnology and pharmaceutical firms: Insights from a knowledge management perspective. *Information and Technology Management, 2*(2-3), 289-301.

Samiotis, K., Poulymenakou, A., & Doukidis, G. (2003). Understanding knowledge management interventions: Evidence from supporting (e-) banking activities. *Knowledge and Process Management, 10*(3), 175-191.

Savary, M. (1999). KM and competition in the consulting industry. *California Management Review, 41*(2), 41-52.

Singh, N., Furrer, O., & Ostinelli, M. (2004). To localize or to standardize on the Web: Empirical evidence from Italy, India, Netherlands, Spain, and Switzerland. *Multinational Business Review, 12*(1), 69-87.

Soliman, F. & Youssef, M. (2001). The impact of some recent developments in e-business on the management of next generation manufacturing. *International Journal of Operations & Production Management, 21*(5/6), 538-549.

Soo, C., Devinney, T., Midgley, D., & Deering, A. (2002). KM: Philosophy, processes, and pitfalls. *California Management Review, 44*(4), 129-150.

Spiegler, I. (2003). Technology and knowledge: Bridging a "generation" gap. *Information & Management, 40*(6), 533-539.

Srinivasan, R., Lilien, G.L., & Rangaswamy, A. (2002). Technological opportunism and radical technology adoption: An application to e-business. *Journal of Marketing, 66*(3), 47-60.

Stankosky, M. (2004). Tackling a unified KM framework. *KM World, 13*(1), 1-19.

Storck, J. & Hill, P.A. (2000). Knowledge diffusion through "strategic community." *Sloan Management Review, 41*(2), 63-74.

Tang, F. (2000). Taiwan to become a knowledge-based economy within 10 years. Retrieved from *http://www.thenews.com*

Tigre, P.B. & Dedrick, J. (2004). E-commerce in Brazil: Local adaptation of a global technology. *Electronic Markets, 14*(1), 36-47.

Trethewey, A. & Corman, S. (2001). Anticipating k-commerce. *Management Communication Quarterly, 14*(4), 619-628.

Turban, E., Aronson, J.E., & Liang, T.P. (2005). *Decision support systems and intelligent systems.* New Jersey: Prentice-Hall.

Turban, E., Lee, J., King, D., & Chung, H.M. (2000). *EC: A managerial perspective.* New Jersey: Prentice-Hall.

Wang, L.K., Scherban, D.M., & Bonnici, J. (2005). International business: Taiwan's edge in the Asian financial crisis. *Journal of American Academy of Business*, *6*(1), 143-150.

Wang, S. & Ariguzo, G. (2004). Knowledge management through the development of information schema. *Information & Management*, *41*(4), 445-456.

Warkentin, M., Bapna, R., & Sugumaran, V. (2001). E-knowledge networks for inter-organizational collaborative e-business. *Logistics Information Management*, *14*(1/2), 149-162.

Wenger, E. (2004). Knowledge management as a doughnut: Shaping your knowledge strategy through communities of practice. *Ivey Business Journal Online*, .

Wigand, R.T. (1997). EC: Definition, theory, and context. *The Information Society*, *13*(1)-16.

Wiig, K.M. (1994). KM: *The central management focus for intelligent-acting organizations*. Arlington, TX: Schema Press.

Wiig, K.M. (1995). *KM methods: Practical approaches to managing knowledge*. Arlington, TX: Schema Press.

Williams, R. & Cothrel, J. (2000). Four smart ways to run online communities. *Sloan Management Review, 41*(4), 81-91.

Wolfinbarger, M., & Gilly, M.C. (n.d.). comQ: Dimensionalizing, measuring and predicting quality of the e-retail experience. Retrieved from *http://www.crito.uci.edu*

Wolfinbarger, M. & Gilly, M.C. (2001). Shopping online for freedom, control, and fun. *California Management Review, 43*(2), 34-55.

Woods, E. (2004). KM past and future: Changing the rules of the game. *KM World, 13*(1), 12-14.

Zack, M.H. (1999a). Developing a knowledge strategy. *California Management Review, 41*, 25-145.

Zack, M.H. (1999b). Managing codified knowledge. *Sloan Management Review, 40*(4), 45-58.

Wen-Jang (Kenny) Jih is currently a professor of computer information systems at the Jennings A. Jones College of Business in Middle Tennessee State University. He obtained his doctorate in business computer information systems from University of North Texas in 1985. He previously taught at Longwood University in Virginia, University of Tennessee at Chattanooga, Auburn University in Alabama, and Southern Methodist University in Dallas. From 1997 to 2001, Dr. Jih served as the Dean of School of Management of Da-Yeh University, a comprehensive private institution in Taiwan. His recent research interests include knowledge management, e-commerce, m-commerce, and innovative approaches to information systems education.

Marilyn M. Helms is the Sesquicentennial Endowed Chair and professor of management at Dalton State College. She works closely with the area community on research projects and training programs. She teaches production management, quality, and entrepreneurship. She is the author of numerous journal articles and writes a column for the Dalton (GA) Daily Citizen *newspaper. She earned her doctorate from the University of Memphis. Prior to joining DSC, she was the George Lester Nation Professor of Management at UT-Chattanooga. She was awarded a Fulbright teaching award to Coimbra, Portugal. Her research interests include manufacturing strategy, quality, and international management.*

Donna Mayo is chair of the Division of Business Administration and associate professor of marketing at Dalton State College. She holds a PhD in marketing from the University of Alabama. Dr. Mayo has published numerous scholarly and applied works in a variety of journals. Her research interests include entrepreneurship, marketing communication, e-commerce, and customer service. She has consulted with more than 30 private and public organizations in the areas of marketing research and customer service.