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Towards a KM framework for e-business projects within SMEs

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ABSTRACT

The need for taking a knowledge-based view (KBV) within the information systems (IS) field has received increasing attention. This ongoing research, by analyzing and synthesizing the literature on innovation-knowledge management and on e-Business adoption in SMEs as one IS problem, focuses on two things. Firstly, it highlights the need for taking a KBV to e-business projects within the SME sector. Secondly, by adopting a content-process-context model (Pettigrew & Whipp, 1991; Snowden 2002), it proposes an inter-organizational KM (IOKM) framework for further research. By analyzing the literature, this paper highlights that the IOKM framework needs to be dynamic to address the contingencies of each phase of e-business adoption. The originality of this research is on providing an exploratory discussion of KM issues within e-business project phases, combining theories of inter-organizational linkages, KM, innovation and e-business adoption and implementation, in order to provide a theoretical lens to study how we can facilitate IT innovation through the lens of the KBV.

KEYWORDS

Knowledge management, e-business projects, SMEs, knowledge networks

INTRODUCTION

The need for taking a knowledge-based view (KBV) within the IS field has been recognized. According to a meta-research analysis by Schultze and Leidner (2002), who have studied knowledge management (KM) in IS research, "there is ample evidence that traditional notions within IS research are being reinterpreted in light of our understanding of knowledge, its creation, and its transfer" (p: 222). For example, IT innovation has been examined through the lens of knowledge creation by Nambisan, Agarwal and Tanniru (1999). According to the variety of problems that KM solutions intend to address within firms, there are several issues with its conceptualizations. For instance, Michael Zack (2000) raised a question "If managing knowledge is the solution, then what's the problem?"

One of the traditional IS problems is adopting e-business among small and medium-sized enterprises (SMEs). This problem is of interest for society as a whole since the SME sector plays a very important role in most economies around the world and innovations like e-business adoption plays an important role in the survival and growth of SMEs, since it affects the way of doing business and allows them to participate in supply networks (e.g. Levy & Powell 2005).

E-business needs to be implemented through information and communication technologies (ICTs) but it also requires knowledge that SMEs, due to their limited resources, may not possess. They need to acquire or access some part of the e-business knowledge areas from their environment and inter-organizational relationships. Recent research has approached this topic through two theoretical lenses, the resource-based theory of the firm and the theory of inter-organizational relationships, and has highlighted the importance of adopting new directions (e.g. Cegarra-Navarro and Martínez-Conesa 2007; Chong, Ooi, Lin, and Tang, 2009; Joen, Hecker and Holland, 2006; Lin and Lee 2005; Parker and Castleman, 2009; Chong et al., 2009). These two inter-related lenses provide a basis to study e-business through inter-organizational knowledge management (IOKM) as a new direction; however, this novel approach could face some challenges because of the missing theories in the literature of e-business and the KBV. Using a conceptual-analytic approach, this paper proposes an IOKM conceptual framework for e-business projects within SMEs, by reviewing the relevant literature[1] to clarify four

[1] That is, peer-reviewed academic journal articles listed in ABI Inform Global, Proudest Computing, ProQuest European Business, and ProQuest Asian Business, involving conceptual or empirical work between 1998 and 2009, and focused on SMEs and knowledge management.

main questions: 1).What knowledge (i.e. content) is needed to manage e-business projects? 2). How can the required knowledge be managed (i.e. process) for e-business projects? 3). How does the environment (i.e. network characteristics as the context) influence the management of the required knowledge? And finally 4) How does an SME gain useful external knowledge from its environment to enhance its innovation project?

The primary contribution of this paper is to develop an extended and integrated perspective of the KBV to provide a theoretical lens to study how we can facilitate IT innovation through the lens of the KBV. In the rest of the paper, we provide a brief review of the characteristics of e-business in SMEs, and e-business research so far, specifically in the SME sector. Then, IOKM in the SME sector is presented. Finally the proposed framework and its implications are discussed.

E-BUSINESS PROJECTS IN THE SME SECTOR;

According to Boone and Ganeshan (2007:1195) "e-business technologies [are] the use of the Internet or any other digitally enabled inter or intra-organizational information technology to accomplish business processes". Although these technologies are being deployed to support business processes within the organizational context, this research focuses on the e-business technology itself (e.g. B2B portal, EDI and extranets), and its knowledge issues for implementing such technologies. According to Rogers (1983) an innovative project can be considered in two phases (Prescott and Conger, 1995) including: 1. adoption (knowledge-persuasion-decision), and 2. implementation (implement-confirmation). These two simple stages are also relevant in the SME sector (cf Elsammani, Hackeny, and Scown, 2004). Here we argue that e-business projects within SMEs have idiosyncratic characteristics that need to be discussed through an IOKM lens. In this regard we highlight some features of e-business within SMEs and also show the trends in e-business research.

Features of e-business in SMEs

E-business technologies have been considered inter-organizational information system (IOS) (e.g. Chong 2006) and reasonably e-business in an SME's supply chain requires the co-adoption of two or more organizations in that supply chain. Using inter-organizational information systems (IOSs) is considered imperative for a successful supply chain (Kauremaa et al., 2009) and has been associated with significant supply chain efficiency improvements (Lee & Billington, 1992; Mukhopadhyay et al., 1995; Gunasekaran and Ngai, 2004; Barua et al., 2004; Boone & Ganeshan, 2007 cited by Kauremaa et al., 2009). However, the rate of IT adoption and particularly IOS development in SMEs is low (Chong et al., 2009).

E-business as a knowledge intensive project

E-business among SMEs is characterized by multi-faceted perspectives and represents phenomena that have been considered as "too large and complex to be encapsulated within one study, one discipline, or one methodology" (Al-Qirim 2004). Aligned with this, scarce resources, low IT expertise, and poor management knowledge are reported as some factors which affect and inhibit IT development and IOS development, among SMEs (Dhillon & Caldeira 2000). E-business, according to Swanson (1994) can be considered as a type III innovation since e-business will affect business process technologies, business products and business integration (p: 1077). This type of innovation has a strategic importance to business and at the same time has both a business and an IS professional orientation (p: 1082). In this regard, e-business innovation can be a complex project for companies, particularly for SMEs, since it needs to draw on a variety of knowledge areas to complete the project successfully. Therefore e-business projects are considered as knowledge-intensive projects. This means that access to required knowledge for these projects is considered as a critical success factor (e.g. Dubelaar et. al, 2005; Sensis 2009).

E-business as a network intensive project

In the context of IT adoption, SMEs have different characteristics from larger companies (e.g. Archer et al., 2008; Jeon et al., 2006). Regarding their limited resources compared to larger organizations, SMEs have to incur higher risks when it comes to adopting ICTs such as e-business technologies (Chong et al., 2009) because such systems may change the entire business of SMEs. SMEs lag larger firms in terms of adopting new technologies, including e-business, but because of SMEs' willingness to adopt an innovative approach, and environmental pressure from their supply chain (e.g. Levy & Powell 2005), they need such innovation. Based on Chong (2006) the most significant factors related to extent of deployment of e-business in SMEs, are: 1. the amount of communication between SMEs and their partners, and 2. the variety of information sources. This suggests that in SMEs, a higher intensity of communication with other organizations may increase the extent of deployment of e-business among them.

Trends in e-business adoption and assimilation theories

There is extensive research on adoption and implementation of e-business in SMEs, however it still lacks a socio-economic theoretical basis (Parker & Castleman, 2009). In the current literature, the most commonly-used

theories in studying e-business adoption among SMEs are: Porter's models, the resource-based view of the firm (RBV), the technology acceptance model (TAM), the theory of planned behavior and diffusion of innovation (DOI) (Parker &Castleman 2009). However, Chong et al. (2009) mentioned that many organizations which are adopting e-business, focus on relationship factors, which the existing theories like the diffusion of innovation (DOI) model do not discuss. Parker and Castleman (2009) point to the need for research into this subject through new theoretical lenses. Recent studies have argued that there is a need to shift the direction of IT adoption from studying traditional models such as DOI to other emerging areas. Focusing on the resource-based view (RBV), one of these directions considers e-business knowledge and KM as an important organizational capability needed for managing e-business projects (e.g. Jones et al., 2003; Lin & Lee 2005; Cegarra-Navarro & Martínez-Conesa 2007). The other new lens in this domain is the theory of inter-organizational relationships (e.g. Lockett & Brown, 2004; Parker & Castleman, 2009; Chong et al., 2009). These new inter-related lenses in the SME context encourage the study of e-business through inter-organizational knowledge management (IOKM).

NEED FOR IOKM FRAMEWORK IN THE SME SECTOR

One of the main influencing factors on the survival and growth of SMEs (e.g. Levy & Powell 2005), is the innovation phenomenon. By reflecting Schumpeter's (1934) claim that innovation makes new combinations of knowledge, Kraaijenbrink et al. (2007) argued that any organization needs external knowledge to be innovative, since occurrence of any innovation (e.g. a new product) needs integration of existing and new knowledge. Moreover, because knowledge is continuously changing and depreciating, every organization needs external knowledge (Kraaijenbrink et al. 2007). In this regard, SMEs collaborate with other companies through collaboration networks or strategic alliances (Ding & Peters 2000) to acquire or access external knowledge (e.g. Giannakis 2008; Wong & Aspinwall 2004; Kraaijenbrink 2006) and the way that SMEs do so plays a very important role in achieving innovation (Edwards 2007).

Although there is increasing realization and acceptance that knowledge management (KM) is crucial for SMEs (e.g. Thorpe et al., 2005; Pillania, 2006; 2008), very few studies have focused on inter-organizational knowledge management (IOKM) and knowledge networks in general and SME in particular. Moreover, SMEs maybe more than the larger organizations, need to acquire external knowledge and share their knowledge with their partners for different reasons. Although knowledge may be created internally through conducting research and development or via individual learning, based on the KM SME literature, (e.g. Wong & Aspinwall 2004) it is rarely the case for SMEs. Although internal capability and external collaboration are not substitutes for one another, but are complementary (Powell, et al., 1996); access to external knowledge through inter-organizational relationships seems vital, especially for SMEs. According to the characteristics of e-business within SMEs, Table1 illustrates the potential of IOKM in studying the e-business projects in SMEs.

Table 1 Potential of IOKM to study e-business projects in SMEs

e-business characteristics in SMEs	Potential of IOKM to study the subject
e-business is a knowledge-intensive project	e-business leads to a major change to the business model and business processes, so IOKM deals with highly heterogeneous knowledge required for a complex project (Kraaijenbrink and Wijnhoven, 2008).
e-business is network-intensive project	SME highly need external knowledge integration (Powell, Koput, and Smith-Doerr, 1996; Wong and Aspinwall, 2004), so IOKM deals with knowledge integration from external sources through focusing on a variety of inter-organizational relationships.

IOKM IN E-BUSINESS INNOVATION: A CONCEPTUAL FRAMEWORK

To implement e-business, Gossain and Kandiah (1998) claimed that SMEs must be aware of the benefits in their surrounding environment. Cegarra and Conesa (2007) mentioned that this awareness is important for designers, implementers and users to know how customers and suppliers would help them to evaluate, select, implement and use an e-business system. Koh and Maguire (2004) mentioned that SMEs may have to rely on outside consultants and significant knowledge transfer to make a viable contribution to their e-business adoption. This is very problematical according to Soriano et al. (2002) as most SMEs cannot afford to employ private consultants, and there is a gap between SMEs' needs and knowledge that is supplied by SMEs' IT vendors or advisors (Jones et al., 2003). However, more than private consultants, IT suppliers may have a key influencing role in e-business adoption (Beckinsale et al., 2006) and customers' pressure seems central in such adoption (Beckinsale et al.,

2006; Levy & Powell, 2003; 2005). Beckinsale et al. (2006) call for more research on the details of relationships between IT suppliers, consultants and SMEs. By analyzing the existing literature on KM frameworks in e-business projects, and the innovation literature, it seems that there are three main arguments that could contribute to e-business innovation among SMEs.

The first argument is about the importance of acquiring new knowledge for an innovation project (e.g. Inkpen and Tsang 2005). This novel knowledge is mainly sourced from external parties through inter-organizational relationships and IOKM, and via networking. The second argument refers to the importance of knowledge processes for high-performing innovative firms. For instance, absorptive capacity has been considered as critical factor for firms' innovativeness (Zahra and George 2002). Drucker (1993) mentioned that a firm needs to have the capacity of generating knowledge and applying it in the form of innovation (Chen et al., 2007), and the knowledge process is typically presented as a catalyst for innovation (Scarbrough, 2003). The third argument focuses on the role of the [knowledge] networks in which firms are embedded, on firms' innovation behavior and performance (Uzzi and Gillespie, 2002). According to Nahapiet and Ghoshal's (1998) theory, to describe k-networks (social capital, in their terms) there are three important dimensions, which are structural (refers to the overall pattern of connections between actors, which is mainly measured by strength of ties), relational (refers to the particular relations people have, such as respect and friendship, which mainly focuses on trust and trustworthiness and norms and sanctions) and cognitive (refers to those resources providing shared interpretations and systems of meaning among parties including shared language, codes, and narratives). It is argued that to improve the innovation, firms need a network structure that matches the particular properties of the knowledge that is going to be communicated (e.g. Hansen 1999, 2002; Bustamante 2007).

While first and second arguments have been discussed in the literature of e-business projects in SMEs, the need for doing research on the role of knowledge networks (3nd argument) as a source of influence on SME owner/manager decision-making has been recognized. The current literature however, has separately focused on the effects of knowledge processes and to some extent knowledge properties on e-business rather than examining all three aspects together (i.e. knowledge itself, KM processes and knowledge networks). These three distinctive but interrelated dimensions are really close to the content-process-context framework provided by Pettigrew and Whipp (1991). Moreover this idea, to some extent, is similar to Snowden's (2002) content-narrative-context framework of 3rd generation of KM, which says that the most appropriate process (narrative) to deliver the knowledge content is highly dependent on nature of that content and within its context. In the IOKM literature, the content of the knowledge can impact on the process of the knowledge and is also impacted by social networks of SMEs' staff as the context of IOKM, for instance the source of the knowledge (e.g. Kraaijenbrink 2006; Brenner 2007) and the kind of relationships like strong or weak ties relationships (Sammarra & Biggiero 2008). Using this framework, now we present an integrated lens to study the e-business project as a knowledge-intensive innovation project within the SME sector.

Table 2 The proposed framework for undertaking research on e-business knowledge networks of SMEs

KBV themes / e-business stage	KBV themes			
	Characteristics of each e-business stage	**Knowledge content**	**Knowledge processes**	**Knowledge network characteristics**
Adoption phase Knowledge-persuasion-decision	Lacks information about e-business Actively seeks information/detail about e-business Owner/ manager weighs the advantages and disadvantages of using e-business	What are the characteristics of knowledge (i.e. content) that SMEs need to communicate within each phase?	How can the required knowledge be managed (i.e. process) for e-business projects within each phase?	How does the environment (i.e. network characteristics as the context) influence the management of the required knowledge?
Implementation phase Implement-confirmation	Determines the usefulness and may search for further information Decision to continue using the innovation and may use the innovation to its fullest potential			

In this regard, we review the relevant literature to clarify three main questions: What knowledge (i.e. content) is needed to manage e-business projects, and what are the characteristics of such knowledge? How can the required knowledge be managed (i.e. process) for e-business projects? How does the environment (i.e. network characteristics as the context) influence the management of the required knowledge? As illustrated in Fig. 1, the

framework proposed is based on first, consideration of content, context and process (Pettigrew & Whipp, 1991), and second, major stages of an e-business project; namely adoption and implementation (Prescott and Conger, 1995; Elsammani, Hackeny, and Scown, 2004), since as discussed in the literature, adoption and continued usage characteristics are determined by different factors (e.g. Karahann et al., 1999).

What knowledge (i.e. content) is needed to manage e-business projects?

According to Brenner (2007) only by understanding the combination of types of knowledge and the ways that knowledge transfer takes place, can knowledge transfer be explained comprehensively. However, as mentioned in the KM literature (e.g. Brenner, 2007; Sammarra and Biggiero 2008), IOKM tends to ignore what types of knowledge are transferred, and particularly in what way they are transferred. Kraaijenbrink and Wijnhoven (2008) discussed the need for different organizational capability to manage the heterogeneity of knowledge in external knowledge integration. In this regard, through a literature review, in this section we conceptualize the heterogeneity of e-business knowledge. (see Table 3)

Table 3 Summary of the literature on knowledge content heterogeneity

Knowledge heterogeneity	Authors	Model explanations
Hierarchy	Fahey et al., 2001	Know-what (i.e. to evaluate the current and future changes in the e-business era); know-how (i.e. to understand how organizations should adopt these changes); and know-why (i.e. to determine why these changes are likely to occur for the foreseeable future)
	Allard and Holsapple, 2002	Descriptive, reasoning, and procedural knowledge of e-business
	Cho et al., 2006	Strategic level, conceptual level and operational level
Areas	Fahey et al., 2001	Knowledge about assets, business processes, customer solutions, strategy and rivals
	Chen, 2003	Business, technical, and organizational
	Jones et al., 2003	Customer, technology and marketplace knowledge
	Chan and Rosseman, 2003	In ERP projects, defined six areas of knowledge: 1. business, 2. technical, 3. product–specific (i.e. ERP product), 4. company–specific, 5. project management, and 6. communication, coordination and cooperation to integrate the previous five types of knowledge
	Sammarra and Biggiero, 2008	1. Technological knowledge enables firms to respond to the rapidly changing technological environment. 2. Market knowledge, defined as organized and structured information on the market. 3. Managerial knowledge refers to competences and know-how necessary to efficiently and effectively coordinate and supervise organizational resources and processes. This includes both operational and applied knowledge and more abstract and complex knowledge.
Properties	Alavi and Leidner, 2001, adopted from Polanyi	Tacit/explicit knowledge continuum; degree of tacitness (tacit knowledge is gained through experience, mental models, while explicit knowledge is articulated).
	Szulanski, 1996; Hansen, 1999, 2002; Argote et al., 2003	Causal ambiguity (difficulty in understanding the whole concept); in order to communicate effectively the knowledge being exchanged needs to be well understood or needs to have a low degree of "causal ambiguity". Complex/non complex knowledge.
	Hansen, 1999	Knowledge can be a stand-alone piece or a part of a system: a stand-alone piece like a software module can be easily transferred.
	Uzzi and Lancaster, 2003	Knowledge availability; because the "ownership" of knowledge often leads to real problems of knowledge access and hoarding; public knowledge (belongs to a group) and private knowledge (belongs to an individual).

In the e-business domain, knowledge has been considered as lifeblood (e.g. Allard & Holsapple 2002), however, it not clear that what is exactly meant by e-business knowledge. A few studies are targeted at large companies (Fahey et al., 2001), but based on the idiosyncratic characteristics of SMEs (e.g. Sparrow 2005; Wong and Aspinwall, 2004; Wickert and Herschel, 2001), it is not clear whether all these areas are relevant in the SME sector. Technological knowledge for instance seems critical, according to lack of IT literacy among SMEs. However by studying 32 firms engaged in innovation collaborations, Sammara and Biggiero (2008) showed that more than technological knowledge, market knowledge and management knowledge are required to be

exchanged as well. Beyond the knowledge areas, to identify the heterogeneity of the e-business knowledge comprehensively we may need to address two other concepts: hierarchy (Cho et al, 2006; Fahey et al., 2001) and properties of the knowledge. The summary of our literature review is presented in Table 3. Based on our literature review, these factors seem very important e.g. knowledge transfer and sharing relies on the properties of the knowledge in question (e.g. Zander & Kogut 1995; Argote et, al. 2003). In spite of the importance of this aspect of the content, the authors cannot find any research to show the properties of e-business knowledge. Here we argue that based on the characteristics of the e-business stages, it seems that different kinds of content are needed within e-business adoption and implementation.

Based on the characteristics of the content in terms of hierarchy, area and properties (see Table 3), in the adoption stage, it seems that SMEs' owners/managers search for know-what and know-why knowledge to make decisions. Strategic and conceptual knowledge needs are more important compared to operational knowledge. However, in the implementation stage, know-how knowledge seems to be the major concern for SMEs, since SMEs in this stage try to understand how organizations should adopt new e-business models and processes. Moreover, in an adoption stage SMEs' owners/managers search for all three types of knowledge to make decisions, although business knowledge may receive more attention since e-business is considered a strategic weapon against rivals. In the implementation stage, technological and organizational knowledge are likely to be the major concern for the implementation team, since SMEs in this stage try to understand how organizations should adopt these changes and how it can deploy the system. Last but not the least, in the adoption stage SME owners/managers, to a large extent, rely on their informal social network, which includes friends and acquaintances (e.g. Beckinsale et al., 2006; Parker and Castleman, 2009) so it is expected that they deal with non-codified, non-complex (because of the features of social networks cf. Hansen 1999, 2002) but both private and public knowledge. However, in the implementation stage, IT team members are likely to share complex (Ko et al., 2005)codified technological and organizational knowledge. And this kind of knowledge could not be very private. Hence according to heterogeneity of knowledge areas, properties and hierarchies, the IOKM framework needs to be dynamic, to address the contingencies of each phase of e-business adoption**.**

How can the required knowledge be managed (i.e. process) for e-business projects?

According to the IOKM literature in the SME sector, it is argued that external knowledge integration (EKI) is a critical process for many organizations, since there is general lack of knowledge in the company (e.g. Kraaijenbrink, Wijnhoven & Groen, 2005). In e-business projects, there are very few research studies to show how we can manage the required knowledge needed for e-business projects. For instance Lin and Lee (2005), by studying the impact of organizational learning and KM factors on e-business adoption, found that knowledge acquisition, sharing and application are important factors in innovation processes in e-business projects. Moreover, they showed that training availability, technical expertise and the knowledge level may positively affect e-business systems adoption level (Lin and Lee, 2005). Lin and Lee (2005) defined three processes of knowledge acquisition, sharing and application, which can affect e-business adoption level. However there are some limitations in their work.

First, this framework seems not comprehensive. To address the acquisition process e.g. in their questionnaire they just focused on the customer and supplier knowledge as external knowledge, however there are other important sources like consultants, peer companies, research institutes, branch organizations and fairs, magazines and database/internet (e.g. Kraaijenbrink et al, 2005). Second, Kraaijenbrink et al. (2006) in a similar way, but without focusing on e-business adoption, defined EKI as a stage model including identification, acquisition, and utilization of external knowledge, each of which consists of several sub-processes, but the results of their research show that this model did not work for SMEs. They expected the stage model confirmed—because of their limited span of attention and resources, SMEs are likely to concentrate either on identification, acquisition, or utilization of external knowledge. However, the results, contrary to their expectations, show that new product development managers in high-tech SMEs do not focus on a single EKI stage, but spread their attention more equally over the stages (Kraaijenbrink et al., 2006). Third, based on a quantitative approach, Lin and Lee (2005), focused on exploring the relationships between knowledge processes and e-business adoption. However it is not clear how SMEs deploy these processes, since there are some unique characteristics for SMEs. One of these characteristics refers to the source of knowledge in SMEs which is their social networks (i.e. their knowledge networks that later will be discussed in the *context*). Most of the existing literature on IOKM, while focusing on large organizations, has addressed IOKM that occurs through formal agreements between participant organizations. However social networks which are governed by informal shared norms instead of legal contract (Szarka, 1990), could be a suitable platform for knowledge transfer (Appleyard, 1996; Liebeskind et al., 1996 cited by Levina, 1999), particularly for SMEs (Parker & Castleman, 2009). Therefore there is a need to research the characteristics of social networks as a main source of external knowledge, particularly in the SME context, and to show the knowledge processes firms need in each of two stages of e-business adoption. Due to the different characteristics of each stage, it seems that we need different attention in each of them. The summary of our literature review on this is presented in Table 4.

Based on the characteristics of the external knowledge process (see Table 4), in the adoption stage, an owner/manager looks into his/her social network to capture the required knowledge to make a decision on whether to adopt e-business or not. In the adoption stage, it seems that the SME owner/manager focuses on identification of, and access to knowledge, therefore acquisition (i.e. firm's capability of identifying and acquiring externally generated knowledge (Zahra and George 2002)) seems to be critical in this stage. Also assimilation (Zahra and George 2002) is needed to allow SMEs to analyze, process, interpret, and understand the information obtained from external sources.

Table 4: Summary of the literature and our propositions on knowledge process

Authors	Model explanations
Zahra and George, 2002	Four primary stages associated with absorptive capacities are acquisition, assimilation, transformation and exploitation.
Sambamurthy and Subramani, 2005	1. Knowledge coordination (faced by individuals or groups when the required knowledge exists, or is believed to exist, but requires a search for expertise, and is aided by an understanding of who knows what and who can be asked for help). 2. Knowledge transfer (from the source to the SME). 3. Knowledge re-use (refers to using an existing standard knowledge rather than needing to devise a unique solution to a problem).
Lin and Lee, 2005	Knowledge acquisition, knowledge sharing and knowledge application are important factors in innovation processes in the e-business context.
Kraaijenbrink et al., 2006	The EKI stage model includes identification, acquisition, and utilization of external knowledge; each of these consists of several sub-processes.

However, in the implementation stage, SMEs try to use e-business in their daily business processes. Therefore SMEs need to synthesize their existing knowledge, for instance business process knowledge with the new knowledge of the e-business (transformation and exploitation, according to Zahra and George, 2002),and people need to learn such new knowledge, e.g. through training. Hence the point is that the IOKM framework needs to be dynamic, as a matter of knowledge processes to address the contingencies of each phase of e-business adoption.

How does the environment (i.e. network characteristics as the context) influence management of the required knowledge?

The immediate environment of the SMEs within which they manage their e-business projects is a network of companies, individuals and information systems, which typically comprise SMEs' customers, suppliers, and SMEs' IT vendors (Beckinsale, Levy, and Powell, 2006). Through these partners and others like peer companies, consultants and even their family and friends (e.g. Ghazali, 2005; Parker and Castleman, 2009), they acquire and share their needed knowledge for their daily business. This advisory network is sometimes called a knowledge network (k-network). A k-network includes individuals and collections of individuals, such as groups, departments, organizations, and agencies. Increasingly, the nodes also include non-human agents such as knowledge repositories and web sites (Carley, 2002, cited by Contractor and Monge, 2002). This kind of network operates in every organization and is not limited to network-type organizations, matrix organizations, or team-based organizations (Allee, 2000). To study the role of such networks, we review the literature on social networks, inter-organizational networks and innovation, mainly with focus on the structural aspect of networks (Nahapiet and Ghoshal, 1998).

It is expected that characteristics of SMEs' k-networks affect their knowledge transfer performance. First, there is a relationship between network structure and knowledge-sharing performance. For example, Kane and Alavi (2005) studied the three characteristics of tie strength, centrality and density. They found that similar information systems with a similar base of people can have different performance outcomes because of the particular way in which they configure their k-network topology. Most of the time, a network with strong ties was related to a better performance. However, there are several benefits of weak ties that have been mentioned in the literature, including access to a variety of knowledge (Granovetter 1973), better knowledge searching and low cost to maintain (Hansen 1999), and less dependency and vulnerability. Therefore these two main theories on network structure of social capital, which are termed closure theory and structural holes theory can enhance understandings of patterns of knowledge sharing (Burt, 2000). Tie strength, density and centrality of the network are critical features of a knowledge network structure that impact the outcome of knowledge management initiatives (Bustamante, 2007). Second, it is argued that the structure of the k-network needs to match the specific characteristics of the knowledge that is going to flow over the network (e.g. Bustamante, 2007). Hansen (1999) studied the impact of k-network structure on the sharing (search or transfer) of knowledge

in the intra-firm k-network. Hansen focused on two of the main characteristics of knowledge: degree of tacitness and degree of complexity. Also he studied tie strength as one particular k-network characteristic. He found that strong ties between groups are better for non-codified and complex knowledge transfer. Weak ties are better for knowledge searching.

Table 5: Summary of the literature (mainly adopted from Kane, 2006, p.18, Marouf, 2005, pp. 72-73) and our propositions on knowledge network structure

Authors	Model explanations
Coleman, 1988	Dense networks are more beneficial than sparse networks.
Burt, 1992	Due to their role as knowledge broker, central individuals enjoy information benefits in terms of timing, access, and referral.
Granovetter, 1973, 1982, 1999	Weak ties lead to access to different types of knowledge that help to achieve the desired result.
Tsai and Ghoshal, 1998	Patterns of resource exchange predict product innovation.
Rulke and Galaskiewicz, 2000	The whole network performs better when the central nodes are better able to serve the role of knowledge broker; and teams with generalist knowledge perform better in centralized networks.
Hansen, 1999, 2002	1. Weak ties are better at searching for new knowledge. 2. Weak ties are better at transferring codified knowledge. 3. Strong ties are better at transferring non-codified knowledge. 4. Strong ties are detrimental to transferring codified knowledge.
Thomas, Hunt, Ogden and Neale, 2003	Isolated experts have more unique knowledge. Central experts perform differently than peripheral experts in knowledge-sharing and in terms of the value of knowledge shared.

Given this background, it is reasonable to expect that network configuration may influence the performance of k-networks of SMEs. However most of the literature in this domain refers to internal k-networks and does not focus explicitly on the context of external k-networks, particularly in the SME sector. The summary of our literature review on this area is presented in Table 5. Now, according to two phases of innovation, and based on the characteristics of the knowledge networks as matter of closure network theory vs. structural hole theory (see Table 5), we can argue that in the adoption stage, it seems that structural hole theory is more relevant, since an SME owner /manager needs multiple points of view to understand the required e-business. This aspect is close to the role of knowledge brokerage (Burt, 1992, 2000) and exploration of knowledge (Dyer and Nobeoka, 2000). Therefore here it seems better to have a weak ties network. However, in the implementation stage, a dense network seems more efficient since an e-business team needs to share more complicated knowledge (Hansen, 2002) to exploit the knowledge(Dyer and Nobeoka 2000). Hence the point is that the IOKM framework needs to be dynamic, in relation to knowledge networks, to address the contingencies of each phase of e-business adoption.

How does an SME gain useful external knowledge from its knowledge network members to enhance its innovation?

It is argued that a match between a corporation's network structure, knowledge processes and the characteristics of the knowledge that is needed to be acquired are critical to answer this question (Hansen 1999, 2002; Alavi and Kane, 2005; Bustamante, 2007). In the innovation literature, Schilling and Phelps (2007) argued that networks that have both clustering (closure network) and some amount of random linking between them are valuable for creativity and innovation. Each of these network configurations can encourage search vs. transfer processes (i.e. different knowledge processes) regarding the knowledge content that is going to be communicated (Hansen 1999, 2002). See Table 6.

Table 6 Some aspects of the interplay between knowledge content, knowledge processes, and knowledge network structures (adopted from Hansen, 1999)

	Closure network	Sparse Networks
High degree of complexity and tacitness	Closure networks are not efficient for the search process, however they can moderate the problems of knowledge transfer.	Weak ties facilitate the search process, however they have severe problems in the process of knowledge transfer.
Low degree of complexity and tacitness	Closure networks are not efficient for the search process, however there are few knowledge transfer problems.	Weak ties facilitate the search process and there are few knowledge transfer problems.

In this paper we argue (see Figure 1) that during an innovation project, there are multiple stages with different characteristics, therefore to be successful in e-business projects, SMEs need to be aware of such characteristics in terms of the content of the knowledge (content), needed knowledge processes (process) and required knowledge network (context), in order to provide a dynamic and appropriate mechanisms to manage the e-business (innovation) project successfully. Hence the point is about the interplay between knowledge process, knowledge content and k-network structure, which can influence e-business innovation. This interplay is expected to differ within different phases of innovation.

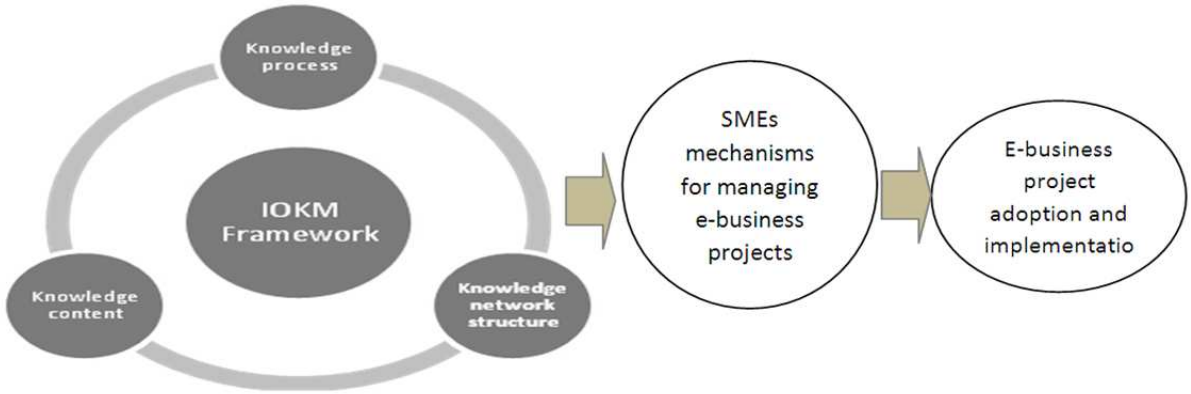

Figure 1The interplay between knowledge process, knowledge content, and knowledge network structure, and their effect on e-business projects

CONCLUSION

Although e-business, as a particular form of inter-organizational arrangement, has existed for almost two decades, it still lacks a socio-economic theoretical basis. This paper, first by reviewing the trends in existing theories in e-business adoption and assimilation, shows why the KBV is of interest as a lens to apply in studying IT innovation. Secondly, it describes how the proposed framework can contribute to e-business projects in SMEs by addressing both IOKM and innovation perspectives. However, the conceptual framework presented here is still in its early stages and requires substantial empirical work. Nevertheless by analyzing the relevant literature, this paper highlights the main current gaps in the IOKM and provides a framework for future research.

Implications for knowledge management theory and literature

Previous research has focused on relationships between properties of knowledge and network structure, and knowledge processes, however recently the need to consider the interplay of all of these aspects has been recognized. Moreover this paper highlights the need for a dynamic view to study the interplay between these factors that influence innovation.

In this paper, many seemingly fragmented theories including the network structure theory (Granovetter, 1973; Burt, 1992; Hansen, 1999, 2002); the theory on content of knowledge (Allard and Holsapple, 2002; Cho et al., 2006; Fahey et al., 2001; Allard and Holsapple 2002; Cho et al., 2006; Jones et al., 2003; Sammarra and Biggiero, 2008; Uzzi and& Lancaster, 2003; Sammarra and Biggiero, 2008); and the knowledge processes (Nonaka 2002; Kraaijenbrink, et al. 2007, Wijnhoven & Groen, 2005; Kraaijenbrink et al, 2006; Lin and Lee 2005; Nonaka, 2002; Kraaijenbrink et al., 2007); are discussed. By reviewing these bodies of literature, a conceptual framework is proposed to enhance the understanding about SMEs' e-business adoption through the so-called lens of the KBV. This paper highlights that the KM framework needs to be dynamic to address the contingencies of each phase of e-business adoption. This ongoing research can contribute to KM theory and SMEs' management practices as well. However, this research could also have some implications as by-products for IT innovation among SMEs.

Implications for management practice in SMEs

Participating in a network is one of the most important challenges which an entrepreneur faces since the beginning of their business (Szarka, 1990). The networking phenomenon for SMEs seems primarily a source for knowledge integration as a competitive response (Hanna and Walsh, 2002; Kraaijenbrink et al, 2007). However, to manage the networking practice, this paper suggests that SMEs owner/managers may need to consider the interplay between knowledge content, knowledge processes and k-networks as context. This content-process-context framework can help SME owner/managers to evaluate their organizational mechanisms as managerial interventions to facilitate such innovations. For instance, according to different stages of an e-business project, SME owner/manager should make proactive efforts to play a dual role within his/her network, i.e. during the first phase to acquire context-free or industry-specific knowledge (mainly with a low degree of tacitness), the network should be rich in brokerage with actors connecting different professional organizations to each other and to the external environment. However, in the second phase, to deal with more tacit and firm-specific knowledge, the network should be rich in clustering where everyone is directly connected to everyone else.

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