

MAPPING THE COMPLEXITY OF KNOWLEDGE MANAGEMENT THOUGHT IN TECHNOLOGY MANAGEMENT

A Critical Review of Information Systems Studies

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ABSTRACT: Knowledge management has increasingly been regarded as an important research theme in information systems studies, with a substantial accumulated stock of empirical research. The purpose of this paper is to compare and contrast theoretical and methodological approaches to knowledge management in extant information systems studies. In so doing, the author builds a new typology and discusses relevant research questions and fundamental ontological and epistemological assumptions about the nature and study of social sciences, and the nature and scope of organizational knowledge. Previous typologies have tangled together basic assumptions about the nature and study of social sciences and the “transformative” nature and scope of organizational knowledge. The present typology acknowledges that these two dimensions need to be untangled to be able to discriminate and analyze fundamental assumptions that researchers, explicitly or implicitly, adopt in the study of knowledge management and information systems in organizations. This distinction is necessary because the implementation and use of information systems has the potential to enhance, or hinder, the transformative attributes or characteristics of organizational processes. This new typology is used to conceptualize, categorize, and criticize a sample of selected research articles, and to suggest new directions for research.

RESUMEN: La gestión del conocimiento es un tema importante y actual en el área de estudios de sistemas de información, que se caracteriza por un vasto legado de investigación empírica. El principal objetivo de este escrito es comparar y contrastar las varias perspectivas teóricas y metodológicas en referencia a la gestión del conocimiento en estudios de sistemas de información. Con este propósito, el autor de este escrito construye una nueva tipología, y discute importante interrogantes que requieren ser investigados, así como fundamentales premisas ontológicas y epistemológicas sobre la naturaleza y estudio de las ciencias sociales, y la naturaleza y alcance del conocimiento organizacional. Tipologías en la literatura existente han fusionado estas dos dimensiones y sus premisas. La nueva tipología reconoce que estas dos dimensiones necesitan ser tratadas por separado para poder diferenciar y analizar las premisas fundamentales que investigadores adoptan, explícitamente o implícitamente, en sus estudios. Esta distinción es necesaria ya que la implantación y uso de sistemas de información tienen el potencial de multiplicar o disminuir los atributos o características transformativas de procesos organizacionales. Esta tipología es aplicada en la conceptualización, categorización y crítica de una muestra selecta de estudios empíricos, y en la dirección de investigación futura.

The bulk of the existing knowledge management literature emphasizes and connects with established research areas in strategy and organization. There are some excellent conceptual reviews and critiques presented in the *Handbook of Organiza-*

tional Learning and Knowledge (Dierkes, Antal, Child, & Nonaka, 2001) and the *Handbook of Organizational Learning and Knowledge Management* (Easterby-Smith & Lyles, 2003). More recently, there were some attempts to develop integrative typologies that review, categorize, and synthesize empirical studies (Shipton, 2006; Thomas & Allen, 2006; see also Romme & Dillen, 1997). These typologies and reviews have predominantly focused on the above-established areas, but reviews that examine the intersection of knowledge management, strategic management, organization theory, and information technology (IT) remain underdeveloped in the mainstream management literature (Mizruchi & Fein, 1999; Salazar & Sawyer, 2007; Schultze & Leidner, 2002). This is especially surprising given that IT has altered the organizational and strategic landscape in much the same way as earlier general purpose technologies, such as the steam engine and the electric motor. Therefore, this is the relevant time to systematically review knowledge management approaches applied in existing empirical studies,

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and also formulate a set of research principles or recommendations in order to guide the design and positioning of future empirical studies.

This paper develops a two-dimensional typology using broad categories related to assumptions about the nature of social science in the horizontal axis, and two categories related to the nature and scope of organizational knowledge in the vertical axis, shown in Table 1. The main justification of developing a typology is that this kind of theoretical classification provides the basis for strong research by breaking the continuous world into discrete and collective categories well suited for detailed analysis. Typologies enable researchers “to recognize fundamental structures and relationship, and [they are] a basis for theory development and hypothesis testing” (Rich, 1992: 758). This type of typological review is not uncommon in the organization science field, but is long overdue in the technology and innovation management field (Mizuchi & Fein, 1999; Salazar & Sawyer, 2007; Schultze & Leidner, 2002). Multiparadigm reviews offer the possibility of creating fresh insights because they evaluate the different ontological and epistemological assumptions and, therefore, can scrutinize different facets of organizational phenomena and can produce markedly novel and integrated theoretical synthesis of the subject matter under study. A major aim, therefore, is to help researchers and practitioners to make sense of the diverse and fragmented information systems literature. It is worth highlighting that these abstractions should not be viewed as theory yet, but as a way to categorize and organize empirical studies according to their ontological and epistemological assumptions about the nature of social sciences, and nature and scope of organizational knowledge (Bacharach, 1989; Doty & Glick, 1994; McKelvey, 1982; Rich, 1992).

The rationale of the horizontal axis lies in the inherent theoretical assumptions about the nature of social science. Drawing from Burrell and Morgan (1979), Gioia and Pitre (1990), and von Krogh, Nonaka, and Ichijo (2000), I define two broad dominant paradigms or worldviews—the *positivist/objectivist* paradigm (i.e., positivism, functionalism, representationism, cognitivism, modernism) and the *interpretivist/subjectivist* paradigm (i.e., antipositivism, interpretivism, antirepresentationism, constructionist, postmodernism). More specifically, an interpretivist/subjective approach to social sciences encompasses a nominalist ontology, antipositivist epistemology, voluntaristic approach to human nature, and idiographic methodology (Burrell & Morgan, 1979). In contrast, a positivist/objectivist approach to social sciences encompasses a realist ontology, positivist epistemology, deterministic approach to human nature and nomothetic methodology. Positivist scholars (e.g., Marx) hold that social matter, however messy, is lawful, and that the explanations of social facts do not differ fundamentally from explanation in natural sciences. The idiographic/nomothetic discussion involves the difference between

particulars (e.g., individuals) and universals (e.g., organizations as an indivisible whole). For a more detailed critical discussion on the social science divide, see Bunge (1998) and Burrell and Morgan (1979).

Assumptions about the nature and scope of organizational knowledge are arrayed on a second dimension, shown in Table 1. I define two categories or types. *Type one* focuses on the conversion of information to knowledge with a practical emphasis on dissemination, combination, and use of explicit and tacit knowledge; *type two* focuses on the social process of knowing with a practical emphasis on mobilizing and steering learning and innovation (Howells, 2003; Salazar, Hackney, & Howells, 2003a, 2003b). The empirical evidence reviewed here suggests that there is a shift away from thinking about knowledge as a commodity or asset that organizations have or may acquire, toward the study of knowing as something that individuals and teams do and how this can, in turn, be harnessed by the firm.

The present typology differs from previous typologies in three aspects. First, it integrates assumptions about the nature and study of social sciences and the nature and scope of organizational knowledge. These two dimensions have been discussed separately in extant reviews. For instance, Romme and Dillen’s (1997) review approaches the second dimension about the nature and scope of organizational knowledge using the concept of single-loop and double-loop learning, but does not include the first dimension. The resulting analysis is biased toward a systems dynamics perspective (i.e., nomothetic view of the world), neglecting the socially emergent subjective view. In contrast, Thomas and Allen’s (2006) review implicitly covers the first dimension about the nature of social science applied to the concepts of “learning organization” (i.e., implicit cognitive-possession/positivist/objectivist view) and “organizational learning” (i.e., implicit social-process/interpretivist/subjectivist view), but does not cover the second dimension. The resulting analysis fails, therefore, to distinguish between the levels or scope of transformation in relevant organizational processes (e.g., knowledge transfer and dissemination versus knowledge sharing and collaboration). For a conceptual discussion of cognitive-possession and social-process perspective applied to the organizational learning/learning organization debate, see Chiva and Alegre (2005). One more recent contribution is the typology developed by Shipton (2006), which introduces two dimensions based on the distinction between individual (i.e., idiographic) and organizational (i.e., nomothetic) learning, and prescriptive/normative versus explanatory/descriptive focus. The main limitation of her typology, however, is that it does not explicitly account for the “transformative” nature and scope of organizational knowledge.

Second, the present classification is put in context to concrete information studies literature. Previous conceptual

TABLE I
Typology Based on Worldviews, Nature of Knowledge, and Organizational Levels

	Positivist view	Interpretivist view
	I	II
Type one	<p>a. Intra-organizational Prescriptive emphasis on dissemination, combination, and use of explicit and tacit knowledge within organizational boundaries. Codification, combination, and dissemination of knowledge. Mapping knowledge flows. Building “intelligent” technologies.</p> <p>b. Interorganizational Prescriptive emphasis on dissemination, combination, and use of explicit and tacit knowledge across organizational boundaries. Acquiring tangible knowledge stocks. Measuring intellectual capital.</p>	<p>a. Intra-organizational Focus on individual and collective interpretation, externalization, and internalization. Questioning underlying organizational assumptions and mental models. Leveraging individual and group intelligence through creative problem solving. Institutionalizing experimentation and learning.</p> <p>b. Interorganizational Focus on individual and collective interpretation, externalization, and internalization. Developing intangible knowledge assets within interfirm network. Using incentives to institutionalize knowledge sharing. Nurturing trust and long-term relationships.</p>
	III	IV
Type two	<p>a. Intra-organizational Prescriptive emphasis on mobilizing and steering learning and innovation within organizational boundaries. Prescribing new logic of control, coordination, and influence.</p> <p>b. Interorganizational Prescriptive emphasis on mobilizing and steering learning and innovation across organizational boundaries. Taking advantage position and control of network. Enhancing absorptive capacity by proliferating knowledge exchange channels.</p>	<p>a. Intra-organizational Focus on understanding the impact that social processes of structuring and communication have on learning and innovation within organizational boundaries. Implementing firmwide coaching strategies. Facilitating collaboration between cross-cultural teams. Understanding and reengineering interaction patterns.</p> <p>b. Interorganizational Focus on understanding the impact that social processes of structuring and communication on learning and innovation across organizational boundaries. Leveraging strategic communities and redefining their network governance. Coevolving with network partners. Fostering entrepreneurship.</p>

frameworks in the specialized IT literature have adopted a highly theoretical stance, and have neglected the systematic review of empirical studies (Schultze & Leidner, 2002). Third, I introduce a practical subclassification related to the scope of organizational boundaries—that is, intra- and inter-organizational boundaries. The empirical evidence reviewed here shows that firms are adopting new IT at both intra- and interorganizational levels via virtualization strategies and the implementation of Internet-based information systems.

In summary, all of the above typologies have tangled together basic assumptions about the nature and study of social sciences and the “transformative” nature and scope of organizational knowledge. The present typology acknowledges that these two dimensions need to be untangled to be able to discriminate and analyze fundamental assumptions that researchers, explicitly or implicitly, adopt in the study of knowledge management and information systems in organizations. This distinction is necessary because the implementation and use of

information systems has the potential to enhance (or hinder) the transformative attributes or characteristics of organizational processes (e.g., Internet-enabled knowledge sharing and collaboration) (Newell, Scarbrough, & Swan, 2001).

I use this typology to review, categorize, and conceptualize a sample of selected research articles from 24 academic journal titles published from 1990 to 2005 (see the Appendix). An original sample of 1,727 articles was identified using a key word search using “knowledge” and “information systems” in the Web of Science online database. The articles were then contrasted and categorized using the typology; the selection process identified the representative studies that are discussed in detail below.

THE SCOPE AND FRAGMENTATION OF INFORMATION SYSTEMS STUDIES

The wide scope of information systems studies makes it difficult for researchers and practitioners to make sense of the diverse and fragmented literature. This section summarizes key developments and trends in this literature:

Before the advent of radical developments in IT such as electronic data interchange (EDI) systems and more recently the Internet, the transformational attributes of IT were confined to productive activity performed internally, within the organization’s physical boundaries. There was a strong emphasis on the scientific management aspects of computer-based work prior to the advent of more ubiquitous technologies such as the personal computer and the Internet in the early 1990s (Brancheau & Wetherbe, 1987; Yap, 1989).

Because Internet-based technologies, and their applications, have become more widely adopted and diffused, the span of issues has shifted, for example, from computer–human interface and productivity-enhancing issues at the individual and departmental level, toward wider organizational and strategic transformational issues (Cassiman & Sieber, 2007; Salazar & Sawyer, 2007). For instance, Cassiman and Sieber (2007) focus on how new technology simultaneously affects demand and cost structures leading to a radical transformation of existing market structures. They provide fresh evidence on the dynamics of industry transformation and the impact of the Internet on market structure.

More recent studies on information systems–enabled transformation have focused on areas such as Internet-based customer communities, Internet-based organizing, knowledge-based relationships, interfirm business network governance, value cocreation, and the coevolution of strategic alliances in electronic markets and industries (Ahuja & Carley, 1999; Brews & Tucci, 2004; Chatterjee, Grewal, & Sambamurthy, 2002; Gittell & Weiss, 2004; Hackney, Burn, & Salazar, 2005; Nambisan, 2002; Rice & Juniper, 2003; Rothaermel & Sugiyama, 2001; Salazar et al., 2003b; Schultze & Orlikowski,

2004; Tomkins, 2001; Wheeler, 2002; Wiesenfeld, Raghuram, & Garud, 1999).

The implementation and exploitation of information systems and technology enables the virtualization of social relations and work processes, which are increasingly spanning the traditional organizational boundaries of the firm. For instance, Voelpel, Dous, Brenner, and Kolbe (2007) illustrate Siemens’s efforts to establish a sustainable, global knowledge-sharing system. Voelpel et al.’s study explores practical aspects on how to support the global transfer of knowledge by establishing a knowledge culture within the multinational organization.

The specialized information systems literature highlights the role of collaboration, knowledge sharing, and learning in competitive strategies and innovation. The intensity and pace of innovation in knowledge-intensive and hypercompetitive industries has brought the need for organizations to exploit their collaborative networks to boost their own innovation capacity. Recent literature highlights the relationship of new technologies and new organizational forms, such as virtual organizations and virtual interorganizational networks, such as virtual customer–supplier communities. Large companies and specialist supply firms have grown to become virtual interorganizational networks with their partners acting essentially as knowledge brokers in many of the value-creating relationships. A supplier can use the Internet and electronic commerce technologies in such a way that it can interconnect information systems across multiple sites in the value chain and let information flow across functional boundaries.

Scholars have studied the role that IT plays in promoting information sharing, collaboration, and coordination both within and across organizational boundaries; and transformational attributes include the role that ITs have on reshaping interorganizational collaboration and innovation (Barrett, 2007; Chudoba & Watson-Manheim, 2007; Hayes & Walsham, 2005; Voelpel et al., 2007). Researchers have also acknowledged the symbiotic relationship between the approaches for IT development and the emergence of interorganizational forms and structures (Barua, Koanana, Winston, & Yin, 2004; Hinds & Kiesler, 1995; Orlikowski & Robey, 1991; Orlikowski, Yates, Okamura, & Fujimoto, 1999; Wiesenfeld et al., 1999). Researchers have observed that organizational forms can be facilitated by explicit and ongoing adaptation of technology to changing contexts of use. That is, activities of a few individuals can shape users’ interaction with technology, modify features of the technology, and alter the context of use.

A firm’s competitive strategies can be enhanced by the implementation of virtual organizational forms based on complex, interdependent social networks and knowledge-sharing relations, which in turn, are enabled by developments in IT such as Web-based applications and electronic communication. Firms are entering into wider alliances and networks of firms

through electronic means. This includes the emergence of firms whose business strategies and marketing, production, and innovation activities are essentially enabled by Internet-based IT infrastructures, applications, and services. These are key drivers for providing completely new products and services. Innovation originates from enabling dialogue between stakeholders about their products and services (Child & McGrath, 2001; Cohen & Manking, 1999; DeSanctis & Fulk, 1999; McLoughlin & Jackson, 1999; Salazar, Hackney, & Howells, 2003b; Snow, Lipnack, & Stampts, 1999).

The implementation and use of IT also enables electronic commerce and markets, which are characterized by multichannel transactional and relational processes, and that may span different activities of the value chain. Research shows that firms are gradually moving in the direction of outsourcing most aspects of their value chain and rely heavily on strategic alliances and collaborations with specialist and intermediary companies to become more flexible and faster to market. Electronic markets have evolved into interconnected one-stop shops, providing specialized services with affiliate firms. Worldwide Internet commerce spending is projected to exceed \$8.75 trillion in 2009, as projected by IDC (2007). Electronic business models have evolved from basic electronic procurement and electronic commerce into more complex electronic market “ecosystems.” These electronic market environments are characterized by rapid exchange of information within a virtual network of customers and suppliers working and evolving together to create and recreate value-added processes. Scholars have suggested that electronic businesses are not just members of certain industries but parts of an ecology that incorporates different industries, where the driving force is not pure competition but coevolution (Agre, 2000; Amit & Zott, 2002; Andersen & Andersen, 2002; Hackney, Burn, and Salazar 2005; Howells, 2003; Huygens, Baden-Fuller, Van Den Bosch, & Volberda, 2001; Iansiti & Levien, 2004; Jenkins & Floyd, 2001; Park, Mezas, & Song, 2004; Salazar, 2004; Salazar & Miles, 2003; Salazar et al., 2003a; 2003b). Problematic issues dictated by emergent global and distributed innovation scenarios are the forms of virtual interorganizational networks and the processes by which individuals build and maintain their network exchanges in context of these virtual environments.

Several scholars are warning us that knowledge management is a broad and fragmented research area that lacks a common conceptual core that could integrate theories of learning- and knowledge-related phenomena in organizations. A lack of consensus may undermine the original concept, leading to its collapse (Gray & Meister, 2006). It is not uncommon for organizational researchers to propose typologies to identify and categorize different aspects of an idea. I intend to systematically review existing applied research in an attempt to integrate disparate views and the lack of definition of the knowledge management concept.

TOWARD AN INTEGRATIVE FRAMEWORK: KNOWLEDGE EPISTEMOLOGIES AND WORLDVIEWS

Knowledge management thought can be characterized by two broad assumptions about the nature of knowledge. These two broad assumptions emphasize (1) the content, intensity, and frequency of the knowledge production and sharing actions or (2) the social patterns or structure of the connections between heterogeneous actors across multiple levels (Argote, McEvily, & Reagans, 2003; Borgatti & Foster, 2003; Dierkes et al., 2001). The first assumption advocates that information and knowledge can be made explicit and be transferred easily regardless of the characteristics of the organizational context. The second assumption acknowledges a more reflective “interpretative” view—that information and knowledge sharing are characterized by being highly tacit and interdependent to the social setting. Likewise, IT-enabled innovation can be characterized by two broad assumptions about the nature of learning. These two broad assumptions emphasize that (1) learning primarily occurs within individuals or (2) learning is the result of a wider and richer socialization process.

A major limitation of existing conceptual frameworks such as Schultze and Leidner’s work is the “ambiguous definition of knowledge management” (2002: 231). For this reason, I define two knowledge management categories that integrate theoretical notions of (1) learning and innovation-related and (2) information-processing and knowledge-related phenomena in organizations.

Type one focuses on the conversion of information to knowledge with a practical emphasis on use, integration, and dissemination of explicit and tacit knowledge. Type one advocates that the implementation of IT in context to distributed innovation processes will not be effective without redefining the ways individuals share, use, and convert information into knowledge (and vice versa) to compete more effectively. Knowledge management systems refer to technologies for processing information and generating and distributing knowledge.

Type two focuses on the process of *knowing* with a practical emphasis on mobilizing and steering innovation. Type two acknowledges that there has been a shift away from thinking about knowledge as a commodity or asset that organizations have or may acquire, toward the study of *knowing* (Ichijo, von Krogh, & Nonaka, 1998). Knowledge management refers to organizational structures such as virtual teams and virtual organizations that increase strategic fit and effectiveness in the utilization and creation of knowledge.

I previously defined two dominant paradigms or worldviews—the *positivist* paradigm and the *interpretivist* paradigm in broad social science terms (Burrell & Morgan, 1979; Gioia & Pitre, 1990; von Krogh et al., 2000). More specifically, the

traditional positivist, cognitive view of individual behavior assumes that people possess objective knowledge, are self-interest and goal seeking, and can act in accordance with their considered judgment. In contrast, the interpretivist, constructionist view proposes that knowledge is socially constructed. In addition to the individual-level views of knowledge and learning, social perspectives (i.e., structuration theory, actor network theory [ANT]) examine the interactions between individual actors engaged in the process of learning. More critical perspectives suggest the need to analyze how knowledge exchanges affect power and social order (Gosain, 2003).

POPULATING THE QUADRANTS: MAPPING INFORMATION SYSTEMS STUDIES

Type One and Positivist

Positivist researchers adopting, explicitly or implicitly, the “type one” notion of knowledge management are advocating that an organization should be analyzed on the basis of *how* knowledge is created, shared, and applied to improve the organization’s capacity for successful innovation; for example, through the use of the groupware technology, the Internet, and electronic commerce systems. The crucial question for this type is, “How effectively are organizations using information and transforming this into knowledge which can be harnessed to gain competitive advantage?”

On an *intra-organizational* scope, the interest of a *positivist* researcher centers on the analysis of how virtual teams share and use joint information, data, and library sources (Table 1, quadrant Ia). Representative example studies adopting this epistemological position are Lee and Lee (2000), Li, Tang, Man, & Love (2002), Massey, Montoya-Weiss, and O’Driscoll (2002), and Wickramasinghe and Mills (2002). Wickramasinghe and Mills (2002) illustrate the importance of integrating a knowledge management focus in e-commerce initiatives in health care. The authors argue that knowledge management systems should support both the subjective and objective aspects of knowledge. Wickramasinghe and Mills based their discussion on a single-case example of the medical automated record system (MARS) at Kaiser Permanente–Ohio. The authors, however, dedicate only half of an A4 page to the discussion of subjective elements of knowledge management supported by MARS. Massey et al. (2002) focus on Nortel’s efforts to reengineer the front-end of its new product development (NPD) process and capitalize on knowledge assets. The change effort was built around a process-oriented knowledge management strategy. The authors reviewed the process design, people, and technology (i.e., virtual mentor) aspects. The authors analyze the managerial, resource, and environmental factors that influenced Nortel’s success. Massey et al. indicate that “the deep understanding of the front-end NPD process allowed for

systematic design of support for and management of its inherent knowledge processes” (2002, p. 283). Lee and Lee (2000) propose an approach to analyzing enterprise resource planning (ERP) implementations from an objective knowledge transfer perspective. From their knowledge management perspective, ERP implementation is seen as a process of bringing explicit business processes to the organization along with other business rules. Li et al. (2002) describe the creation of VHBUILD, a knowledge management system. A case-based reasoning approach is utilized to determine the nature of current problems. It applies previously gained knowledge of case studies and adjusts them to the new situation.

On an *interorganizational* level, type one’s *positivist* view advocates for the effective redesign of the innovation process. Members of the organization must use IT to document and share information across and beyond the boundaries of the firm (Table 1, quadrant Ib). Integrating a variety of information and interpretations would enable complex group problem solving. The creation and development of such virtual teams requires critical analysis and is not always the panacea that is often advocated by the positivist view. Representative example studies adopting this epistemological position are those by Bieber et al. (2002), Gassman and von Zedwitz (2003), Kreis-Hoyeser and Gruenberg-Bochard (2006), and Merali (2000). Merali (2000) uses the cognitive congruence framework to illustrate the importance of individual and collective cognitive congruence. Merali’s paper analyzes the implications of structure, process, and communication design. Garavelli, Gorgoglione, and Scozzi (2002) adopt a similar cognitive approach to investigate the properties of a “knowledge technology” and knowledge transfer processes. Transaction cost theory and distribution channel economics are the theoretical background used by Simons, Steinfeld, and Bouwman (2002) to test a number of case studies in order to determine the effect of e-commerce and Internet technology on physical channel assets. Bieber et al. (2002) describe computer-mediated communications and collaborative knowledge structuring in context to a virtual classroom project. The authors suggest a vision and architecture for a community knowledge evolution system. They propose augmenting a multimedia document repository (digital library) with innovative knowledge evolution support, including computer-mediated communications, community process support, decision support, advanced hypermedia features, and conceptual knowledge structures. These tools, and the techniques developed around them, Bieber et al. argue, would enable a virtual community to learn from, contribute to, and collectively build upon the community’s knowledge and improve many members’ tasks. The resulting collaborative knowledge evolution support system (CKTSS) would provide an enhanced digital library infrastructure serving as an ever-evolving repository of the community’s knowledge, which members would actively use in everyday tasks and regularly update. Gassman

and von Zedwitz (2003) trace four different types of virtual teams and try to determine, using network theory, the issues that lead a company to adopt a specific type of virtual team. Kreis-Hoyesr and Gruenberg-Bochard (2006) provide a theoretical foundation based on the economics of knowledge and the organizational network approach. Subsequently, several hypotheses are derived concerning the use of the knowledge output in this specific organizational mode. The results show that regulations concerning the use of knowledge depend on the partner structure and the kind of research performed in interorganizational knowledge networks. Other theoretical predictions concerning the effects of the degree of diversity of the partners and the specific characteristics of knowledge on the rules for the use of the knowledge output could not be confirmed. In addition to an interpretation of these results, recommendations for further research are also derived

Type One and Interpretivist

For type one, the interpretivist view focuses on individual and organizational internalization and interpretation, both within and between organizations, respectively (Table 1, quadrant II). Representative example studies adopting the interpretivist epistemological position intra-organizationally (Table 1, quadrant IIa) are those by Butler (2003), Damsgaard and Scheepers (1999), Gray (2001), Lu, Yu, and Liu (2003), and Newell et al. (2001). Newell et al. (2001) discuss the adoption of intranet technology as a vehicle for encouraging organizationwide knowledge sharing within a large, global bank. The outcome of intranet adoption was that it actually helped to reinforce the existing functional and national boundaries with electronic fences. The authors adopt a broad interpretivist perspective to advocate that an intranet can be conceptualized as an interactive and decentered technology, which therefore has the potential for multiple interpretations and effects. Newell et al. conclude that although the intranet is often promoted as a technology that enables processes of communication, collaboration, and social coordination, it also has the potential to disable such processes. Lu et al. (2003) use a cognitive learning approach (based on the Group Embedded Figures Test) in determining the learning styles of MBA students and their importance in long-distance Web-based learning. Butler (2003) uses institutional theory coupled with a case-based constructivist approach to illustrate the issues that arise from the implementation of Web-based information systems. Gray (2001) uses Walton's five dimensions framework on dual organizational potentialities to assess the shifting balance of the employee-employer relationship that may be caused by the advent of knowledge repositories. Damsgaard and Scheepers (1999) use institutional theory to develop a taxonomy framework (based on King et al. 1994). This is used to analyze the implementation process of corporate intranets.

Representative example studies adopting the interpretivist epistemological position interorganizationally (Table 1, quadrant IIb) are those by Swan, Newell, Scarbrough, and Hislop (1999), Gosain (2003), Gosain adapts Kim (1993), Detlor (2000), Burstein and Linger (2003), Yakhlef's (2002), and Parikh and Sameer (2002). Swan et al. (1999) argue that a focus on IT to create a network structure may limit its potential for encouraging knowledge sharing across social communities. Two cases are contrasted. One case focused almost entirely on using an intranet for knowledge sharing, resulting on the emergence of electronic fences. In the second case, there was an emphasis to encourage active social networking among dispersed communities, rather than relying on IT networks. The authors advocate for an interpretivist community-based model of knowledge management for interactive innovation and contrast this with a cognitive-based (objective) view that underpins many IT-led knowledge management initiatives. Their community-networking model advocates that knowledge for innovation is socially constructed and based on experience, and that the primary function of knowledge management is to encourage knowledge sharing through networking. Gosain (2003) focuses on the exchange of knowledge across organization boundaries through personal knowledge exchanges. This approach employs market mechanisms to value knowledge and match sources and recipients of knowledge. Gosain's study addresses the following two research questions: (1) What are the key challenges in supporting the exchange of personal knowledge through Web-based marketplaces? and (2) How can personal knowledge exchanges be designed to overcome these challenges? Gosain adapts Kim's (1993) model for individual learning and the construction of mental models and routines that need to be reconciled with those of the recipient. In this view, what is exchanged between individuals is a data stream that is interpreted as information and encoded into the individual's mental models as new knowledge. This research examines companies that were early movers into the personal knowledge exchange space: ExpertCity, SoapBox, HotDispatch, and InfoRocket. Interviews were conducted with the founder/CEO and other senior members of the company's executive teams who typically managed their strategy, business development, and marketing activities. Each of these four cases adopted different approaches to knowledge and its management. ExpertCity took a peripheral participation approach on knowledge transfer and supported rich interactions that facilitate the exchange of tacit knowledge. SoapBox knowledge was explicitly coded in documents that were then exchanged. HotDispatch took a situated view of knowledge, allowing the user to synthesize their solution from a number of responses provided to them. InfoRocket pursued a collective memory approach and tried to build a diverse community that could provide broad expertise on different topics. Gosain, however, is not explicit about the specific communications patterns

and social restructuring that support the learning and innovation processes. Detlor (2000) combines Taylor's value-added model of systems development with Davenport's ideas on information ecology of organizations. Detlor's paper discusses the application of a behavioral/ecological framework to the design of corporate portals. Sørensen and Lundh-Snis (2001) demonstrate using cases of community- and cognitive-based approaches and their differences. The authors stress the importance of community-based approaches to fully understand IT management and implementation. Burstein and Linger (2003) propose a task-based knowledge management framework as a process-oriented approach to understanding knowledge management systems. Their framework focuses on work activity in a post-Fordist context, where technology is implemented to support work activity. Burstein and Linger analyze how IT facilitates knowledge reuse and augment organizational memory. The usefulness of this framework lies in its integration of task performance with reflection and evaluation of the task. The study relied on interpretive methods and involved both action research and interpretive data analysis. The framework incorporates both individual and organizational perspectives on knowledge work. From Burstein and Linger's perspective, task performance requires the actor to achieve task outputs and learn from that performance, which together contribute to the dynamic maintenance of memory. At the organizational level, the memory system contains artefacts that add to the collective knowledge and understanding of tasks, and represents the outcomes of double-loop learning. Yakhlef's (2002) approach is based on Foucault's notion of discourse, and hence adopts a constructivist view of knowledge. The discursive approach is used to elicit organizational knowledge formation from six stories of firms that have entered into various partnerships with IT suppliers. Parikh and Sameer (2002) attempt to combine different learning models (constructivism, objectivism, collaborativism, and socioculturism) under a proposed framework. Their integrated support system architecture utilizes push-pull technologies with the aim of enhancing interactions and learning in an educational context.

Type Two and Positivist

On an intra-organizational scope, the interest of a positivist researcher centers on the analysis of how innovation and learning can be mobilized and steered within the organization (Table 1, quadrant IIIa). The positivist view advocates that for organizations to accomplish innovation, their structures need to be prescribed in such a way that activity is close to the context for knowledge creation, dissemination, and exploitation. On an interorganizational scope, positivist research advocates that current innovation models call for a new set of managerial competencies that are required to manage a shifting set of alliances, because creating value is no longer

confined to the corporate boundary but involves participating in and leveraging the whole value chain (Table 1, quadrant IIIb). Salazar et al. (2003b) conceptualize the strategic effect of new Internet technology, in context to biotechnology and pharmaceutical firms. The authors argue that competitiveness of modern, agile pharmaceutical businesses depends on their ability to create and commercialize new knowledge as much as on their ability to produce new products. Hence, knowledge production and intellectual property management provide a strong foundation for emerging, successful e-commerce strategies. The authors suggest knowledge management plays a key role in determining organizational performance levels and value creation. Salazar et al.'s paper devises a new classificatory framework that categorizes the strategic effect of Internet technology in the biotechnology and pharmaceutical industry, which is based on three key dimensions—converting information into knowledge, the redesign of the innovation process, and knowledge-oriented organizational structuring. The authors extend their framework beyond the boundaries of the firm to include relationship with customers, suppliers, and intermediaries such as specialist biotech companies and health care professionals. Hackney, Burn, and Salazar (2005) review the theoretical relevance of strategic analysis in e-markets and advocates for a coevolutionary approach to value creation and the management of change. A view of strategy is recognized that includes an evaluation of the stages and processes of evolution for these markets. A framework encompassing critical elements such as e-market ecosystems, e-alliances, e-knowledge, and e-systems is developed and advanced for further strategic analysis. The model is believed to be of value for conceptual assessment of virtual business communities where unique attention to continuous innovation and dynamic organizational adaptation are considered imperative for competitive success. This is increasingly characterized by paradoxical issues, such as competing in the present time and building long-term strategic competences for the future. The model is validated with relevant examples and a substantive case study.

Type Two and Interpretivist

The type two interpretivist view focuses on understanding the social processes of structuring, communication, influencing, and learning, both within and between organizations (Table 1, quadrant IV). The interpretivist view advocates that a key organizational element to successful innovation lies in *understanding* the significance of network relationships and new forms of interacting, leading, and organizing. The *social structuring* of organizational activity thus has important implications for the creation, dissemination, and utilization of knowledge and learning. Schultze and Boland (2000) illustrate how a perspective of practice that takes circuits of reproduction into account provides a lens and a vocabulary for understanding

knowledge worker's system requirements, and for exploring the incongruence between workers' situated practices and idealized or espoused practices embedded in technologies. Schultze and Boland rely on Bourdieu's theory of practice to define work practices in the context of circuits of reproduction. Competitive intelligence analysts were the primary focus of analysis. They were one of the intended user communities of KnowMor, a knowledge management technology. The pilot implementation of KnowMor formed part of a transformation to a more flexible and competitive knowledge-intensive firm. The design of KnowMor embodied an informing process of "alert-assess-escalate," also referred to as the "gatekeeper model." The transformation to a knowledge-intensive firm was based on a new way of structuring the field of knowledge work, which included the development of a new vocabulary for classifying work into "value adding" and "commodity." Schultze and Boland engaged in their ethnographic, interpretive research using constant comparison (Strauss and Corbin, 1990). Schultze and Boland generated preliminary organizing categories of interrelated activities, including "just-in-time informing," "just-in-case accumulation," and "why do you want to know questioning." The members of the business research group presented themselves as "value-adding" workers, who proceduralize their work, automate it, and outsource as much of the "commodity" portion of their work as possible. The competitive intelligence analysts' practices of informing made possible the structural division between "value-adding" and "commodity" work. For instance, their "why do you want to know" questioning made them appear to have privileged access to a higher form of understanding about the organization. Their practices of informing reproduced the structure of the field of knowledge work and their position within it. Their situated practices were at odds with the *generalized "gatekeeping" practices embedded in a knowledge management technology* whose implementation they were advocating. Schultze and Boland argue that their *inability to see this incongruence* until very late in the pilot implementation is associated with an understanding of their work practices in isolation—that is, *outside their circuits of reproduction*. The authors conclude that the practices of the competitive intelligence analysis helped them to generate a new configuration of circuits of reproduction.

CONCLUSION AND RESEARCH AGENDA

The inherited incommensurability posture that separates the positivist and interpretivist paradigms had led to a fragmentation in the field of knowledge management in general, and IT in particular.

In the opinion of this author, the widespread use of Nonaka, Reinmoeller, and Senoo's (1998) practical but simplistic model of knowledge conversion as a teaching tool in business schools may have hindered the diffusion of the understanding of the

deeper social processes of structuring and communication supporting learning and innovation.

One of the emergent trends illustrated in this review is that the portfolio of knowledge management research in the IT literature is starting to be less biased toward the positivist view. The literature review and the example cases presented in this paper illustrated that organizations are undergoing continuous change in the way they approach the management of knowledge, their social structuring processes, and strategic orientation. The traditionally positivist view of knowledge management, which sees individuals as suppliers of information and knowledge, is being challenged by the interpretivist view. This new interpretivist approach has become more apparent in recent years.

The organizational and temporal nature of managing knowledge in context to IT implementation requires the modification of the positivist approach. Positivist studies are less useful for examining questions about the dynamics of the mechanisms or processes of change and innovation, and often cannot account for the order and sequence of events that unfold in organizational change processes. Positivist studies are limited in that they assume that a *fixed* number of predicting variables identified at a particular time *determine* actions or decisions regarding the organizational phenomena under study. Variance explanations also assume that an identifiable set of independent and contingent variables can be both identified and used to explain phenomena at a particular level of analysis.

Scholars need to consider theories that have their origins in other perspectives (Gioia & Pitre, 1990). The author acknowledges the above and encourages a more constructive proliferation, wherein scholars develop more comprehensive views by examining and, if possible, *accounting* for the work of alternative research perspectives and, more specifically, alternative knowledge ontologies and epistemologies.

Extending the type one perspective with type two knowledge perspectives at various levels of organizational analysis has the potential to explain second-order transformation in context to innovation. Scholars need to move away from "type one" questions such as "How effectively are organizations using IT to collect and disseminate knowledge that can be harnessed to gain competitive advantage?" toward "type two" questions such as "What is the significance of network relationships and new forms of interacting, leading, and organizing?"

Studies need to be further developed using and combining postmodern notions of knowledge management and organizational learning such as the type two presented in this paper (see also Spender, 2007). This will enable fresh and more powerful explanations of the dynamic organizational nature of IT implementation and its relationship to knowledge creation and learning.

More specifically, a focus on adaptive structuring can assist researchers in gaining deeper and richer insights about

the relational aspects of interorganizational interactions and the endogenous dynamics of knowledge-intensive industries. As one of the growing areas of controversy focuses on how organizations come to share cognitions and norms about appropriate innovative behavior, and how different organizational forms or designs develop, the type two perspective needs to be integrated by researchers attempting to fully understand information systems-enabled innovation. Recent theoretical developments applied to the IT domain are contributing to our understanding, such as Wheeler's (2002) "Net-enabled business innovation cycle," adopting a relational and dynamic capabilities view; Nambisan's (2002) "hybrid" knowledge-based view on virtual new product development communities; and Schultze and Orlikowski (2004) using adaptive structuring and practice perspective.

New insights from recent type two studies such as the above have broadened our understanding of information systems-enabled innovation and transformation, but there is still little empirical evidence as to "What patterns of social structuring of organizational activity have a greater impact on the utilization of IT?" and "What is the strategic value of higher-order processes and social governance mechanisms allowing the generation of and renewal of organizational knowledge and learning capabilities?" To advance our understanding and build more robust and integrated theories, researchers need to adopt research designs that combine type one and type two questions, and articulate the positivist and interpretivist paradigms into more integrated approaches. The "interplay" (Schultz & Hatch, 1996) of "systemic/realist" perspectives (Bunge, 1997, 2003; Johannessen, 1998) with "structuring" and "sense-making" perspectives (Giddens, 1984; Weick, 1995) would be particularly fruitful and challenging.

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APPENDIX: JOURNALS REVIEWED

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| <i>Academy of Management Journal</i> | <i>Journal of Information Technology</i> |
| <i>Academy of Management Review</i> | <i>Journal of Information Technology and Management</i> |
| <i>British Journal of Management</i> | <i>Journal of Knowledge Management</i> |
| <i>IEEE Engineering Management Review</i> | <i>Journal of Management Information Systems</i> |
| <i>Information and Management</i> | <i>Journal of Management Studies</i> |
| <i>Information Systems Journal</i> | <i>Journal of Strategic Information Systems</i> |
| <i>Information Systems Research</i> | <i>Knowledge-Based Systems</i> |
| <i>Information Technology and People</i> | <i>MIS Quarterly</i> |
| <i>International Journal of Information Management</i> | <i>Organization Science</i> |
| <i>International Journal of Information Technology and Management</i> | <i>Organization Studies</i> |
| <i>International Journal of Innovation Management</i> | <i>R&D Management</i> |
| <i>International Journal of Technology Management</i> | <i>Technovation</i> |

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