Integrated Knowledge Portals: Design Challenges and Empirical Approaches

Claudia Loebbecke, University of Cologne
Kevin Crowston, Syracuse University
Nicolas Friederici, University of Cologne

ABSTRACT

Knowledge Portals (KPs) are highly integrative Knowledge Management Systems (KMS) that promise to synthesize widely dispersed knowledge and to interconnect individuals in order to provide a 'one-stop knowledge shop'. Yet, KPs face major challenges in practice, as the intricacies of knowledge exchange are subject to varied individual and social factors. At the same time, growing anecdotal evidence from case studies indicates KPs' enormous potential. This paper takes some initial steps towards a design theory for KPs that more distinctly conceptualizes KPs and emphasizes a KP's role to unify networking and repository KMS features. The paper describes three major challenges to successful KP deployment: (1) knowledge integration, (2) sufficient participation, and (3) favorable organizational culture—and validates these as applicable to KPs through a review of 42 empirical papers.

INTRODUCTION

The knowledge-based view of the firm (Penrose 1995) describes knowledge as a key resource for organizations, suggesting that organizations can be profitably viewed as knowledge systems (Alavi & Tiwana 2002; Gelbuda & Soerensen 2005; Tsoukas 1996). However, as knowledge *per se* resides solely in the minds of individuals, an organization members' collective knowledge is highly distributed, often sub-optimally allocated, not readily available where it is needed, and thus only arduously translated into competitive advantage. The problem of dispersed knowledge suggests the value of the process of knowledge integration, which denotes the combination and systemization of individuals' knowledge to make it available as valuable situation-adapted knowledge (Alavi & Tiwana 2002), leading to higher competitiveness, e.g., by increasing customer focus through more purposeful knowledge reuse (Markus 2001).

However, achieving knowledge integration is a difficult task for organizations. To address this problem, some organizations have developed Knowledge Portals (KPs). KPs are a type of Knowledge Management System (KMS) that strive to provide a 'one-stop knowledge shop', that is, a single point of access to the knowledge available in an organization (or even beyond), re-processed in such a way that it is useful and applicable for a knowledge-seeking user. Yet, knowledge is quite an intractable resource, and implementers of all sorts of KMS struggle both to get individuals to contribute their knowledge and to provide knowledge seekers with useful re-processed knowledge. Organizations have thus faced difficulty to fully obtain value from KPs and frequently experienced disappointments with the modest outcomes that KP deployments have yielded.

The goal of this paper is to take some initial steps towards a design theory for KPs that more distinctly conceptualizes KPs and emphasizes a KP's role to unify networking and repository KMS features. To that end, we organize the remainder of this paper as follows. We first identify the expected components of an information systems design theory. We then conceptualize KPs as combining features of knowledge repositories and of electronic networks and thus move them away from a notion confining them to visualizing web pages. We identify three main design challenges in the context of deploying KPs in the organizational context, namely (1) sufficient participation, (2) a favorable organizational culture, and (3) knowledge integration, offering a set of hypotheses about the performance of KPs. These challenges are then validated and their applicability explored through a more systematic review of findings from a literature review of 42 empirical KP-related studies. The paper also provides short descriptions of instantiations of KPs from the literature review.

TOWARDS A DESIGN THEORY FOR KNOWLEDGE PORTALS

According to Gregor and Jones (2007: 322), an information systems design theory should include eight components: "(1) purpose and scope, (2) constructs, (3) principles of form and function, (4) artifact mutability, (5) testable propositions, (6) justificatory knowledge (kernel theories), (7) principles of implementation, and (8) an expository instantiation". The purpose and scope of our intended theory is to support organizations in their efforts to deploy KPs in the business context by describing the form and function of KPs and by suggesting challenges in deploying KP and ways to address these challenges.

The constructs and the principles of form and function for KPs are outlined in the following section, and include the knowledge artifacts in a repository, organization systems, search, applications, communication and collaboration tools, personalization and role management, and a uni-

fied interface. However, research does not as yet seem to have addressed artifact mutability, that is, how the system changes over time. It requires broader and more generalizable empirical research to understand implementation processes and issues and the potential contribution of KPs. To that end, we derive several research hypotheses for future testing, and support these suggestions with a survey of published studies of KP implementations. The review also provides numerous examples of instiations of KPs, the final component of a design theory; these examples are presented in the appendix.

DEFINITION AND COMPONENTS OF A KNOWLEDGE PORTAL

Towards Defining Knowledge Portals

In this section, we develop a definition and description of the form and function of a KP starting from basic definitions and a review of the literature on KMS and KP. Drawing on the KMS literature, we define *knowledge* as a justified belief that potentially increases an entity's ability to take effective action (Alavi & Leidner 2001). In this view, knowledge is possessed and exercised by persons (Fahey & Prusak 1998) and is derived from flows of information mentally processed relative to existing beliefs and commitments (Nonaka 1994). It is subjective (Durcikova & Gray 2009; Okhuysen & Eisenhardt 2002), dynamic (Desouza & Awazu 2005; Gelbuda & Soerensen 2005), not self-contained (Tsoukas 1996), socially constructed (Alavi & Leidner 2001; Griffith et al. 2003; Wasko & Faraj 2000) and affective (Hwang & Kim 2007; Malhotra 2003; Malhotra & Galletta 2005).

Knowledge *per se* only exists in an individual's mind (Alavi & Leidner 2001; Fahey & Prusak 1998). *Knowledge artifacts* refer to physically stored information such as documents, records, or videos (Davenport et al. 1998; Davenport & Prusak 1998). *Knowledge management* stands for the processes of "identifying and leveraging the collective knowledge in an organization to help the organization compete" (Alavi & Leidner 2001: 113), addressing knowledge creation, knowledge storage and retrieval, knowledge transfer and knowledge application (Alavi & Leidner 2001; Pentland 1995). Knowledge management is complicated by the nature of knowledge and the need to address it indirectly through knowledge artifacts.

Knowledge Management Systems (KMS) are systems that manage or provide access to knowledge artifacts. Several types of KMS can be distinguished. One differentiator is the source of the knowledge provided, internal vs. external. Some KMS process only knowledge originating from members of the organization, regardless of the knowledge seekers. Consider, for example, customer self-service applications like online help services, frequently asked questions sites, and

simple information provision about a company. These might provide a service that external users can access, but if they are not open to external contribution of knowledge artifacts, we classify this KMS as internal, as the information is provided from internal sources.

External KMS involve knowledge flows from external sources towards the internal sphere (note that most of the time external KMS will also address internal knowledge flows). External KMS may directly integrate, for example, customers', suppliers', or business partners' knowledge. Such integration will fundamentally be required if knowledge demand implied by the organization's product or service does not directly correlate with the boundaries of the organization's knowledge (Grant 1996). A special area of application where crucial user groups are particularly multi-faceted is customer-support knowledge, which can come from customers, competitors, public sources and partners, regularly leading to a cross-functional approach (Davenport & Klahr 1998; McKemmish et al. 2009).

Due to more flexible technical solutions, a gradual inclusion of both knowledge flow directions is taking place in implementation (Terra & Gordon 2003). However, a whole new world of issues arises for external KMS, including questions about appropriate standards (Kim et al. 2007; King et al. 2002), knowledge leakage from internal to external (Brown & Duguid 2001), multi-lingual environments (Wingyan et al. 2004) and knowledge politics (Davenport & Klahr 1998). Because of this additional complexity, in this paper, we focus on issues involved only in implementing *internal KMS*, those processing knowledge originating from members of the organization. The additional challenges of external KMS are a topic for future research.

We define a *portal* as a system designed to provide secure, customizable, personalizable, integrated access to dynamic information from a variety of sources, in a variety of source formats, wherever it is needed (Detlor 2004; Smith 2004). An important aspect of a portal is the repository of information to which it provides (ubiquitous) access. Its gateway character is commonly realized in the form of a web site (Smith 2004). In organizational contexts, portals are, hence, embedded in an organization's Intranet, meaning that integration of Internet access and functionalities is a supplementary feature but not a necessity.

Finally, we define a *Knowledge Portal* (KP) as a type of portal that purposely supports and stimulates knowledge transfer, knowledge storage and retrieval, knowledge creation and knowledge application (i.e., the processes of knowledge management), thus addressing inefficiency and ineffectiveness in the use of organizational knowledge. This focus of our paper is shown in Figure 1.

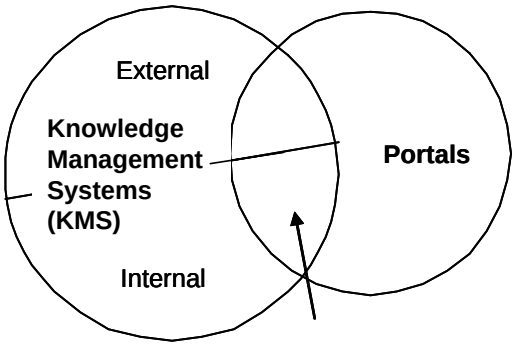

Figure 1. Internal Knowledge Portals

Our definition of a KP differs from those made by previous authors (e.g., Carlsson 2003; Chau et al. 2006; Desouza & Awazu 2005; Firestone & McElroy 2003; Lee et al. 2009; Staab & Maedche 2001; Tsui 2004) who have each introduced rather specific concepts to describe this term. For instance, Detlor (2004), Firestone (2002), and Priebe and Pernul (2003) consider KPs to be the next level of portal sophistication, subsequent to information portals, often explicitly or implicitly referring to a hierarchical distinction of information and knowledge. In contrast, in our view, the key to KPs is their focus on knowledge integration (Lee et al. 2009; Ryu et al. 2005), the so called one-stop-shop. Knowledge integration is important because it is believed to lead to higher competitiveness (Alavi & Tiwana 2002; Grant 1996; Patnayakuni et al. 2006) by transforming specific knowledge into collectively valuable knowledge (Okhuysen & Eisenhardt 2002). KPs specifically address organizational capabilities derived from organizational learning (Ryu et al. 2005).

KP Compenents

As a background to our discussion of problems in implementing KPs, we now discuss typical components of a KP, distinguishing its repository- and network-oriented functionalities. Our definition thus goes beyond views of a portal as just web access to knowledge artifacts. We cover in turn the repository access, knowledge organization system, search, applications and services, collaboration and communication tools, personalization and roles, and the interface, as shown in Figure 2.

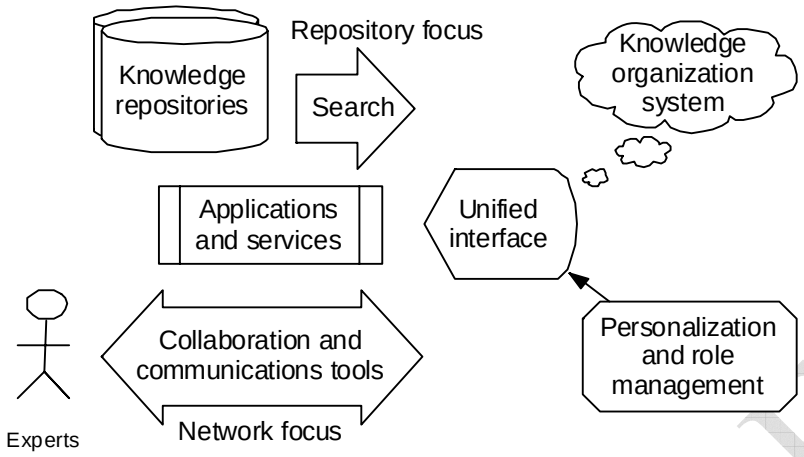

Figure 2. The Concept of a Knowledge Portal and its Components

Repository access. Integrating the access to an organization's repositories of information and knowledge artifacts is a key task for KPs (Collins 2003; Terra & Gordon 2003) in the context of knowledge integration. We refer to this functionality of KPs as the repository focus, as the emphasis is on access to repositories of knowledge artifacts that convey knowledge in codified form. Repositories can be as simple as plain databases (Carlsson 2002) or a more sophisticated KRs, meaning a repository that stores, indexes, and synthesizes knowledge artifacts (e.g., codified best practices), so as to promote knowledge reuse (Gray & Durcikova 2005; Markus 2001).

Knowledge Organization Systems. Knowledge organization systems constitute the most essential component of a KP, as they address knowledge and information integration by structuring meta-information for underlying repositories and networks (Collins 2003). Under this broad concept, we subsume the more specific content management systems, which offer the possibility of classifying and (re-)codifying knowledge artifacts from various sources in an integrative manner (Benbya et al. 2004). Other important sub-categories are document and project management systems, as well as knowledge maps (Lee et al. 2009).

Simple components of knowledge organization systems can be registers and categorizations (Collins 2003). Registers are lists or indexes of information, for instance, comprising glossaries, dictionaries, or authority files (Collins 2003) that facilitate a common understanding and language. Categorizations are relevant in particular for facilitation of the knowledge retrieval process, and are important no matter how powerful the search engine is (Garud & Kumaraswamy 2005). They comprise, for example, subject headings or content separation schemes (Collins 2003).

On a more complex structural level, KPs include taxonomies. First of all, like all portals, a KP regularly contains an organizational information taxonomy (Detlor 2004) (or 'business information directory', Dias 2001), representing a metadata catalog prompted by the different publishing units and ideally comprising all codified information existing in the organization (Dias 2001). In addition, a KP can integrate a variety of other taxonomies, such as simple thesauri or more complex ontologies. The latter, by giving information a semantic underlay (Collins 2003; Liming et al. 2007), can enhance the search function (Horrocks 2008) and other functions of the system (Benbya et al. 2004). The purpose of taxonomic meta-information is to provide context and to indicate where knowledge or knowing individuals can be found (Alavi & Leidner 2001; Liming et al. 2007). Thus, organization systems contribute to navigation and coordination, thereby enhance knowledge retrieval, storage and transfer processes.

Serarch Engine. For all KMS, search represents an essential part of the knowledge retrieval process. Basic categories are standard, concept-based and metadata search (Collins 2003). The integration of varying sources and evolving insights into search is a particularly important issue for KPs (Terra & Gordon 2003). The search engineis intertwined with the KP interface; sit is mostly implemented as a static feature (Collins 2003), requiring adapted and contextualized display (Detlor 2004).

Applications and Services. A KP delivers integrated access to different software tools and a variety of services to facilitate knowledge work (Goodwin 1987), such as multi-repository support, process and web service applications (Collins 2003). Multi-repository support refers to an application that overlies a variety of other repositories, thus providing an integrated point of access for the separate systems. One can consider the integration of applications and the integration of repositories as complementary parts of a holistic integration of existing IT (Carlsson 2002). The main issue is the visual integration of different interface structures without losing the applications' functionality or giving up on the KP's established logic of use.

Collaboration and Communication Tools. In addition to the repository-oriented functions of KPs mainly discussed so far, some types of knowledge are most readily transferred through direct interaction. ToO that end, KPs can also offer *collaboration and communication tools* to connect people (Benbya et al. 2004). We refer to this focus of a KP as the network focus, as it relates to the system's capability to enhance the communications network of participants. Work-group productivity tools and specialized transactional functions make an effort to foster and facilitate collaboration and communication by providing a convenient platform (Detlor 2004). Available tools are extremely versatile, among them email, shared document writing spaces, net meetings, video conferences, (Lee et al. 2009) etc. One notable example is semantic blogging, considered especially pertinent for more decentralized knowledge management (Cayzer 2004).

Personalization and Roles. By definition, portals offer customization and personalization, being important means to reach a higher degree of structure and usefulness of retrieved information and distinguishing it from common web services (Benbya et al. 2004). To do so, *user and role management*, which recognizes and administrates user and access (Carlsson 2002), is required (Collins 2003). Roles can be defined according to tasks (Patnayakuni et al. 2006), with the purpose to pre-determine knowledge flows towards user groups (Carlsson 2002) as specifically as possible. Role management can be considered the groundwork of 'tailored' personalization.

There are two possibilities for supplementary personalization. On the one hand, the KP will allow the users to organize knowledge flows (Collins 2003), providing them with means to avert an overflow of information and save browsing time (Terra & Gordon 2003). This is referred to as explicit personalization or (user) customization. On the other hand, the KP can personalize the web page itself, based on rules or user behavior (Benbya et al. 2004; Forsati & Meybodi 2010), that is, implicit personalization.

Interface. Finally, a KP's *interface* is the point of visual contact with the user. It must offer direct manual access to relevant features. Explicit personalization, for example, must be provided for shown content, but also for the visual representation itself (Smith 2004). The interface's key function is visual integration, having to be geared to the user experience in order to present all functionalities: for example, enabled by knowledge organization systems, it complements content pages by content relevant pages, thereby helping the user to interpret the main body (Collins 2003).

In summary, a KP is portal (i.e., as an information system designed to provide secure, customizable, personalizable, integrated access to dynamic information from a variety of sources) that purposely supports and stimulates the processes of knowledge management (knowledge integration in particular) in order to improve the efficiency and effectiveness of the use of organizational knowledge. KP functionality includes repository-oriented functionality, such as repository access, knowledge organization system, search, and applications and services, as well as network-oriented collaboration and communication tools, together with personalization and role management and a common interface.

HYPOTHESES AND JUSTIFICATORY KNOWLEDGE FOR KP DESIGN

Having presented KP components and functionalities, we next discuss three main challenges for the successful deployment of internal KPs. Drawing on the KMS and KP literature discussed above, we identified three key challenges: (1) achieving knowledge integration, (2) encouraging sufficient participation, and (3) having a favorable organizational culture. While the challenge to

enhance knowledge integration seems most distinctive of KPs, achieving sufficient participation and a favorable organizational culture must not be neglected as knowledge exchange and integration rely on individual and social factors.

Sufficient Participation

A first key issue is that KPs, like all KMS, need to induce sufficient participation to be successful. KPs are useful only as far as knowledge or information is contributed and absorbed by participants (Bock et al. 2006; Durcikova & Gray 2009; He & Wei 2009; Kankanhalli et al. 2005a; Kulkarni et al. 2006; Malhotra & Galletta 2004; Zimmer et al. 2007). Therefore, we propose:

H1: The higher the level of participation, the greater the success of a KP.

As information systems, KPs are subject to the usual range of information systems adoption factors, such as perceived usefulness or ease of use. However, in common with other kinds of KMS, KPs face several additional issues in encouraging participation. We will discuss two in particular: motivation for contribution and knowledge quality.

First, KPs must address the users' motivation to contribute knowledge to the system. Contributing to the system is bound to impose costs, which consist of time, effort, and expected follow-up requests (Kankanhalli et al. 2005a). A further factor is the possible loss of power when a contributor's personal knowledge base becomes less unique, leaving them less irreplaceable and perhaps less valuable after their contribution (Davenport & Prusak 1998; Kankanhalli et al. 2005a). This concern is critical especially in the codification of tacit knowledge, as, in this case, individuals disclose more personal knowledge and partly give up their status (Morris 2001). As they partially avoid codification, network-related KPs should be less susceptible to this issue (Tiwana & Bush 2005). Thus, we further propose:

H2: The more users consider knowledge to be personally valuable, the less likely they are to contribute it to a repository-related KP.

H3: Users will be more likely to contribute knowledge they consider personally valuable to a network-related KP than to a repository-related KP.

For the organization to benefit, participants may need to be motivated to add their knowledge to a repository, even if it does not appear economically rational from their individual point of view (i.e., the individual costs identified above seem to outweigh the actual or potential benefits) (Kankanhalli et al. 2005a; Lin & Huang 2008). The calculation is comparable to a public good dilemma, as sharing of knowledge will make it available to others, irrespective of a direct compensatory reciprocal contribution (Bock et al. 2005; Marks et al. 2008).

Additional motivations might arise out of reciprocity, denoting the expectation of being able to seek knowledge later on as compensation for an own contribution (He & Wei 2009). Moreover, based on the conviction that people share knowledge for altruistic pro-social reasons (Wasko & Faraj 2000), the joy of helping others while expecting nothing or very little concrete in return could be a solid motivator for users to contribute (Kankanhalli et al. 2005a). Finally, while the mere seeking of a social relationship is unlikely to be a participant's prior concern, the wish to belong to a community might matter (Alavi et al. 2005; Wasko & Faraj 2000; Zimmer et al. 2007). Therefore, we propose:

H4: The more a user uses a KP personally, the more likely the user is to contribute to the KP.

H5: The more a user feels part of the group using the KP, the more like the user is to contribute to the KP.

As regards the hierarchical level of goal attainment to which remuneration should be bound, the literature tends to argue in favor of incentives relating to team, unit, or organization goals as opposed to individual bonuses (Gupta & Govindarajan 2000; O'Dell & Grayson 1998; Quigley et al. 2007; van Alstyne 2005). Generally, competition within a group appears to hamper knowledge sharing, whereas the combination of individual and group incentives might make knowledge sharing seem more rational (Siemsen et al. 2007).

H6: Users will be more likely to contribute to a KP if there are group-level performance rewards than if there are individual-level performance rewards.

A second problem in encouraging KP use is encouraging work on validation and maintenance in order to maintaining knowledge quality at a high level. Although it is the perceived information quality that counts, that is "the extent to which an individual believes that a repository provides precise and accurate content that meets his or her knowledge needs" (Durcikova & Gray 2009: 84), validation processes are frequently implemented without reference to participants' beliefs, perceptions, and behaviors (Durcikova & Gray 2009). On the one hand, participants might be less motivated if their contributions are reedited, rejected, or delayed (Alavi et al. 2005). On the other hand, KPs must possibly guarantee high degrees of objectiveness and reliability for other participants through stringent validation (Durcikova & Gray 2009). Assuring quality, usability, relevance and usefulness of the knowledge provided by KPs needs continuous efforts. However, knowledge-management-related approaches to continuance are still under-employed (He & Wei 2009). We finally propose:

H7: Knowledge validation efforts will increase perceived knowledge quality (i.e., increase perceived usefulness) and so encourage use.

H8: Knowledge validation efforts will increase the perceived difficulty of contributing (i.e., reduce ease of use) and so decrease contributions.

Favorable Organizational Culture

A second concern is that KPs need to be accompanied by a favorable socio-cultural environment. Organizational culture describes a holistic arrangement of structures (Bock et al. 2005), to which organization members refer when they act or seek to generate action from others (Bates & Amundson 1995), including rules, practices, behaviors, values, preferences, and attitudes (Kulkarni et al. 2006), marked by varying degrees of visibility (Alavi et al. 2005; Leidner & Kayworth 2006) and little direct alterability (Bock et al. 2005).

Organizational culture may impact the success of any KMS, a KP in particular, by impacting individuals' willingness to share data, a key factor as noted above. For example, a culture may prompt knowledge hoarding: a competitive culture purportedly leads to individuals keeping their knowledge for themselves (Kulkarni et al. 2006; van Alstyne 2005). Contrariwise, a supportive culture may lead to a state of less self-interest, in which the individual no longer considers the organization's knowledge as distinct from their own and even feels the moral obligation to share (Voelpel et al. 2005; Wasko & Faraj 2000), based on the internalization of shared values (Goodman & Darr 1998; Malhotra & Galletta 2005). We therefore propose:

H9: The more competitive the organizational culture, the less likely a user is to contribute to a KP.

Of course, organizations succeed in making their culture part of the individual's mindset to quite varying extents (Gupta & Govindarajan 2000; Voelpel et al. 2005) and these efforts are subjected to external and overall economic factors as well (Goodman & Darr 1998; Voelpel et al. 2005). Beside internalization and identification, organizational culture can create strong social norms, which might significantly limit perceived costs of compliance to the system and reduce knowledge hoarding (Malhotra & Galletta 2005). Finally, as with other information systems, senior management support plays a pivotal role for successfully deploying KPs (Benbya et al. 2004; Davenport & Prusak 1998). Therefore, we propose:

H10: The stronger the social norms for use created by the organizational culture, the more likely a user is to use a KP.

Knowledge Integration

A KP's primary purpose is to be a gateway to various underlying sources of knowledge—multiple repositories, applications or other users. Several authors (e.g., Chau et al. 2006; Davenport et al. 2008; Teo 2005) used the term 'one-stop shop' to describe this purpose. However, to be useful as a comprehensive knowledge supply requires not only pooling of knowledge, but also providing it in a coordinated and meaningful form (Lee et al. 2009). KPs have to provide mechanisms to integrate extensive and dispersed knowledge in various facets and from diverse sources. However, it can be difficult to achieve the right balance between centralization (One-Stop Shop) and decentralization (dispersed knowledge) in knowledge management initiatives (Garud & Kumaraswamy 2005). In other words, we propose:

H11: KPs that provide knowledge integration will be more successful.

A variety of factors complicate knowledge integration. The diversity of the knowledge itself poses challenges. It is in the nature of systems that they are able to deal best with codified knowledge (Desouza et al. 2008; Grant 1996), which derives from the contribution of explicit knowledge or of tacit knowledge that has been explicated. However, explication and codification of knowledge are complex processes (Davenport & Prusak 1998) that are bound to cause costs and to yield knowledge losses (Alavi & Leidner 2001; Grant 1996; von Hippel 1994; Zack 1999) from "divorc[ing] the codified knowledge from its context" (Garud & Kumaraswamy 2005: 29). The difficulty of codification rises with the degree of tacitness of the knowledge (Alavi & Tiwana 2002); hence it is difficult for individuals to communicate tacit knowledge (Alavi & Leidner 2001; Morris 2001; Zhang 2006)—particularly in a generalizable way (van Baalen et al. 2005). This difficulty is a key problem in all KMS, and poses a particular problem for integrating knowledge for a KP. Therefore, we propose:

H12: The more diverse and tacit the knowledge, the less successful the KP will be in providing knowledge integration.

While repository-focused KPs address asynchronous and explicit knowledge transfer (e.g., via a knowledge repository), network-related KPs address tacit knowledge. They provide individuals with means for direct electronic communication or contact (Zack 1999). Such an approach can support a diversity of transfer mechanisms, such as storytelling (Davenport & Prusak 1998; Morris & Oldroyd 2009) or other best-practice sharing (Garud & Kumaraswamy 2005; Voelpel et al. 2005).

H13: Knowledge integration of tacit knowledge will be more successful with network-related KPs than with repository-related KPs.

A second problem arises from the diversity of potential participants in a KP. For example, different mechanisms and incentives must be applied to integrate customers' knowledge (Patnayakuni et al. 2006), as customers' knowledge will be even more dispersed than organizational knowledge (Davenport & Klahr 1998) (as noted, we are focusing this work on internal KPs in part for this reason). Issues of missing structure, relevance, reliability and quality might become even more pressing (McKemmish et al. 2009). Furthermore, regulatory boundaries may constrain full exploitation of all collected information (Davenport & Jarvenpaa 2003). Differing needs for timeliness aggravate the challenge of integrating diverse knowledge. Considering the issue of leakage, KPs need to balance the fact that knowledge that is easily available for customers is also available for competitors (Davenport & Jarvenpaa 2003). Diversity also hampers knowledge transfer in network-related KPs. Practical experience will be sequentially recorded and recommended (Morris 2001), but as such experience is subjective and rooted in action, deriving specific insights can be difficult. This problem will be especially significant if participants are only loosely tied together and have differing tasks that overlap only in general terms (Alavi & Leidner 2001; van Baalen et al. 2005). We therefore further propose:

H14: The more diverse the users of a KP, the less successful the KP will be in providing knowledge integration.

EVIDENCE FROM THE LITERATURE

While there has been a fair amount of prior research on KPs, challenges and best practices for implementation are still emerging. We therefore examined the relevance of the three challenges described above through a systematic survey of published reports of KPs and KP implementations. We chose this approach as it provides a holistic impression of state of academic knowledge about KPs, which should reflect the broad state of practice, while a single empirical study would be limited to the particular KP implementations studied.

Specifically, we present an extensive literature review and analysis of empirical KP studies. The review was conducted from July to November 2009. Using ABI/INFORMS and EBSCO via our university library, we first conducted keyword-based searches on the terms "knowledge portal", "knowledge management system", "knowledge network", "knowledge and intranet", "knowledge integration", "knowledge repository", and "knowledge platform" for the years 1988 to 2008. We then selected those papers that presented empirical studies. In addition, we took advantage of our reading of the theoretical knowledge management literature to identify additional journal papers that presented empirical studies. Note that not all of the papers necessarily described themselves as about knowledge portals; a paper might describe a system that fit our definition of a KP (given

above) while using different words (e.g., a KMS that offers a web interface). Following this approach, we ended up with 42 studies that provide a good sample of work on this topic. The 42 papers reviewed are presented in Tables 2-5 (see Appendix).

In a second step, we closely analyzed the 42 studies. We first grouped the papers into four categories by the nature of the KMS described. We found 11 studies that apply directly to KPs described as such (Appendix Table 1), six that describe repository aspects of systems that we classified as KPs (Appendix Table 2), twelve that discuss the networking aspects of KPs (Appendix Table 3), and another thirteen that are generally KMS-related and discuss both networking and repository aspects (Appendix Table 4). A system was classified as being a KP if it matched the features described above.

As a third step, we coded each paper as to whether it discussed approaches to the three design challenges discussed above. The coding was done based on the definition of the challenges identified above. All three rounds of coding were done by a master and a PhD student, supervised and double checked by the academic mentor (one of the authors). There were few disagreements about the coding; any disagreements were discussed and resolved. A summary of the papers and the codes are given in Table 1.

Table 1. Summary of Codes as Applied to Papers Reviewed

Category	**#**	**Methods**	**KI**	**SP**	**OC**
1. Directly KP related	11	Case study (9), survey (2)	11 (100%)	10 (91%)	10 (91%)
2. Repository related	6	Survey (4), field study (1), lab study (1)	6 (100%)	5 (83%)	5 (83%)
3. Networking related	12	Survey (9), field study (2), lab study (1)	7 (58%)	8 (67%)	8 (67%)
4. Generally KMS related	13	Survey (8), field study (2), case study (1), lab study (1), simulation (1)	5 (35%)	11 (69%)	10 (69%)
Total	42		29	34	33
KI = Knowledge Integration; SP = Sufficient Participation; OC = Organizational Culture					

A first observation is that KPs appear to be a relatively new topic of study, as suggested by the large number of case studies in the first category of studies, that is, the papers that explicitly addressed KP. By contrast, surveys were the most common method applied in the other three topics, those that address KMS more generally.

Second, the first two categories of papers (those addressing KP specifically and repository aspects of KMS) are notable for their general inclusion of all three sets of concerns (all three are mentioned in all but one paper in each group and all papers mentioned approaches to the challenge of knowledge integration). In contrast, studies in the final two groups of papers (those that include network-related KP, i.e., with a focus on communication) less often address concerns of knowledge integration (addressed only in 7 of 12 and 5 of 13 papers in these groups). This difference in focus is consistent with our emphasis on KPs as enabling knowledge integration, but points out that this concern is more significant with regard to integration across repositories rather than networking.

The work reviewed provides support for the hypotheses developed above. For example, Ryu et al. (2005) developed a theoretical model aimed at sensitizing scholars and practitioners about necessary antecedents of knowledge transfer and knowledge integration in a KP[1]. The authors weigh the productivity of learning processes against environmental factors and thereby assess under which circumstances individuals would invest in knowledge transfer through a KP. This individual investment leads to optimal outcomes, in particular if opportunity costs of learning are low, if the acquired knowledge is effective, if a person's initial knowledge base is elevated, if others' knowledge is copious, and if learning from others through communication (as opposed to imitation) is productive. Elevated opportunity costs will occur during economically successful times, implying that at those times, resources might be spent for greater effect elsewhere rather than for the KP-enabled knowledge transfer.

Their work is further complemented by Markus et al. (2002), who developed an IS design theory for a type of problems different from common decision-making, denoted as 'emergent knowledge processes'. These processes refer to highly combinative IS-enabled work patterns, marked by indeterminate 'deliberations', the need for integration of general, specific, and tacit knowledge, and high unpredictability of user groups and work contexts. The authors empirically validate that these kinds of work patterns implicate more complex process, user, and knowledge requirements and that KMS need to integrate repository and networking features. Obviously, this is exactly what a KP seeks. Thus, it could possibly reconcile the disagreement among knowledge management scholars whether a "high-tech 'contentful' system […] or […] a low-tech communication type system" (Markus et al. 2002: 205) is needed for practical knowledge management.

What is more, these findings suggest that, if organizations do not deal with emergent knowledge processes, the integrative approach of a KP might be less appropriate already at the outset. In simplified terms, if an organization only requires straightforward top-down information dissemi-

1 Ryu et al. (2005) conceive KPs as sophisticated "enterprise information portals", but it transpires that their portal concept is largely equivalent to the (slightly broader) conception of KPs in this work.

nation or if it is involved in purely creative 'brain-storming' work, it might only require either a repository KMS or a networking KMS, but not an integrative KP. Hence, KP design must not lapse into the promises of knowledge sharing and knowledge integration or adopt any of the proposed measures in an undifferentiated manner.

Finally, while there are many example instantiations of KPs, principles of implementation are still being worked out. Eventually, KP design must be adapted to a 'systems perspective' (Garud & Kumaraswamy 2005). Owing to the strong interlacements of comprehensive KPs with various actualities of an organization on all levels, KP design must attempt to grasp this distributed knowledge system as a whole. It ought to bear in mind the intractability of knowledge, just as well as its potential value when it is managed considerately and flexibly.

In summary, our study illuminated issues regarding KP design and principles and empirical approaches in the literature. Whereas the data points may not be sufficient to generalize any findings, they contributed to the development of propositions for further empirical testing and the development of theories that explain the design and deployment of knowledge portals (see also Markus 2001).

CONCLUSIONS

Based on definitions from the literature, we distinguish between repository-oriented and network-oriented KPs with different functionalities and concerns. We suggest that KPs can be powerful tools if they properly support knowledge integration, which is a rather new focus of designing and deploying KPs. Achieving knowledge integration represents one of three major design and deployment challenges that KPs face: As illustrated above, KPs need to address knowledge integration, induce participation, and work in a favorable organizational culture.

Overall, the reviewed studies reflect a common conundrum for organizations: either they address tacit knowledge in a long-term focused, interaction-related, and laborious manner within collocated organizational settings, or they content themselves with more frugal explicit knowledge integration, which may still yield timely results and be adequate for extremely dispersed settings (Desouza et al. 2008). Similarly Garud and Kumaraswamy (2005: 26-27) point to "…a key paradox of knowledge management: that an organization's knowledge system contains seeds of its own destruction. Leave it alone, and virtuous knowledge circles may never materialize. Intervene to couple processes at and across different levels, and vicious circles are bound to emerge."

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APPENDIX

Appendix Table 1. Empirical Studies of KPs

Author(s) (Year)	Field of Research	Method	Subjects and Location	Major Findings	KP Design Challenges
Braganza et al. (2009)[2]	Knowledge management through intra-net-based system	Case study	Schlumberger (oilfield services operator) Internation-ally operating firm	- 30 attributes for knowledge transfer through intranet-based KMS found for Schlumberger. - Numerous benefits of intranet-based empirically be validated; theory-practice gap limited. - Intricacies of KMS implementation reaching beyond technology issues depicted & illustrated. - Relevance of metric systems for knowledge management activities underscored. - Knowledge integration as matter of repositories and people concerns all phases of knowledge life cycle.	- Participa-tion - Organiza-tional cul-ture - Knowledge Integration
Chau et al. (2006)	Design of a scientific web portal	Case study	20 Nano science re-searchers, results from NanoPort implementa-tion portal	- In the design of a web KP, various technologies to be considered and integrated. - Layered structure provides best flexibility results for implementation, maintenance, and updating.	- Knowledge Integration
Garud, Kumaras-wamy (2005)	Mutually causal rela-tions of knowledge processes	Case Study	InfoSys (software services operator) Internation-ally operating firm	- KM initiatives with opposite than intended outcome; with knowledge processes frequently being dynamic and mutually causal, they enforce each other. - Coherent KMS must trade off centralization and decentralization. - Important to create unique taxonomies and knowledge hierarchies in knowledge repositories. - Human capital to be explicitly accounted for. - KM in organization as holistic and highly dynamic endeavor, having to adapt quickly and flexibly. - KM evokeing vicious and virtuous processes due to diverse mutually causal processes.	- Participa-tion - Organiza-tional cul-ture - Knowledge Integration
Lee et al. (2009)	Relative importance of KP features for research and develop-ment teams	Survey	142 members of research and develop-ment teams from research institutes Korean public organization	- KP to be integrated with project processes. - Perceived relevance of KP features is contingent on team tasks, such that organizations should dispose of means to align team structures. - Need for collaborative and communication features increases with team size. - Team tasks on commercialization level value coordination higher than collaboration and com-munication. - Need for connection and communication features is contingent on team member dispersion. - Team member dispersion w/o effect on need for collaboration and coordination. - Need for content, customization, and community features not contingent on dispersion or team size.	- Participa-tion - Organiza-tional cul-ture - Knowledge Integration

[2] Does not explicitly refer to KPs, but to web-based or intranet-based KMS.

McKemmish et al. (2009)	Consumer empowerment through KPs	Case study	Breast cancer knowledge online portal project	- Subjectivity and context of knowledge as most pressing attributes a KP must account for. - User-sensitivity and personalization as particularly important KP features; to be enabled by user information-needs analysis, knowledge-domain mapping, metadata modeling. - Quality elements to be included in resource discovery metadata schema.	- Participation - Organizational Culture - Knowledge Integration
Schwabe, Salim (2002)	KP at Xerox Brazil	Case study	Xerox Brazil Brazilian subsidiary of internationally operating firm	- In KP design, object oriented hypermedia design is adequate method to address knowledge dynamics. - KP design for sound codification, reviewing, and access comprises information structuring, navigation structuring, and visualization. - Business game as adequate test and communication measure prior to KP implementation.	- Participation - Organizational Culture - Knowledge Integration
Teo (2005)	Knowledge manage-ment and KPs at Singapore Housing and Development Board	Case study	Singapore Housing and Development Board Singapore-based public organization	- Need to realize value of knowledge sharing and codification. - Management support and encouragement of (informal) knowledge sharing are important. - Subsidiary organizational support factors are incentives, recognition, and reward. - Public organizations, tending to adhere to bureaucratic structures, can particularly benefit from management-supported KM-initiatives. - Phased approach to knowledge management and KPs is recommendable. - Knowledge domain experts important for KM. - People & culture issues prevail over IT problems.	- Participation - Organizational Culture - Knowledge Integration
Teo, Bing (2008)	Task-technology fit for KPs	Survey	154 consultants from consulting firms Chinese firms	- Tacitness of demanded knowledge hampers KP usage. - Task interdependence is not significantly related to KP usage. - KP usage is positively related to performance.	- Participation - Organizational Culture - Knowledge Integration
Van Baalen et al. (2005)	Role of KPs for networks of practice	Case study	Agro-logistics Platform Dutch public and private organizations, external internet users	- KP can impact knowledge sharing of loosely coupled network members. - Fragmented awareness and urgency as necessary conditions for emergence of network of practice. - Knowledge broker as appropriate means to bridge structural holes in NoP by decreasing cognitive distance. - Tacit knowledge is barely or not at all shared in KP-enabled network of practice. - Knowledge sharing in KP-enabled network of practice is not reliant on reciprocity. - Knowledge sharing in KP-enabled network of practice can permeate different structural levels.	- Participation - Organizational Culture - Knowledge Integration

Voelpel et al. (2005)[3]	Web-based knowledge management tool at Siemens	Case study	116 interviews with high-level knowledge management representatives from varying organization 35 interviews with and observation of Siemens representatives, company data Internationally operating firms	• 5 phases of KMS deployment: conception, rollout, momentum building, expansion, consolidation. • KMS deployment is subjected to favorable external conditions that free resources for investments without concrete Return on Assets. • KMS implementation to be carried out forcefully and accompanied by sufficient initial communication and marketing effort. • User need assessment ought to be extensive. • In extremely distributed contexts, KMS implementation to be accompanied by training and promotion measures. • Intrinsic motivation accounts strongly for participation. • Organizational and national cross-cultural barriers as severe barriers to knowledge sharing to be addressed explicitly. • Individual rewards foster participation. • Reward systems that uniquely focus on knowledge contribution intensity lead to cross-culturally unleveled effects and quality issues.	• Participation • Organizational Culture • Knowledge Integration
Zhang (2006)	Wonder's KP	Case study	Wonder, IS development firm Chinese firm	• Mere confrontation with different units' issues enhances a knowledge sharing-friendly organizational culture. • Tacit knowledge exchange is intricate and occurs occasionally when enabled only digitally via KP. • Users' perceptions and usage strongly vary contingent on collaborative spirit. • In-house solutions are preferable to increase design flexibility.	• Participation • Organizational Culture • Knowledge Integration

3 Does not explicitly refer to KPs, but to web-based or intranet-based KMS.

Appendix Table 2. Repository-Related Empirical Studies

Author(s) (Year)	Field of Research	Method	Subjects and Location	Major Findings	KP Design Challenges
Bock et al. (2006)	Norms and knowledge seeking	Survey	Only abstract available	• Social norms positively affect knowledge seeking behavior both directly and through deteriorating the negatively perceived future obligation. • Social norms might deteriorate perceived usefulness of knowledge repositories.	• Participation • Organizational Culture • Knowledge Integration
Desouza et al. (2006)	Explicit knowledge sourcing	Survey	175 employees of software engineering firm Internationally operating firm	• Simplicity is correlated to intention of explicit knowledge sourcing. • Perceived relative advantage determines explicit knowledge sourcing. • Risk aversion accounts for less explicit knowledge sourcing.	• Knowledge Integration
Durcikova, Gray (2009)	Validation processes and knowledge contributing in knowledge repositories	Survey	118 customer service analysts US-based firm	• Transparency of validation processes fosters knowledge contribution and perceived knowledge quality. • Validation duration has no effect on knowledge contribution, but negatively influences perceived knowledge quality. • Restrictiveness of validation processes positively affects perceived knowledge quality, but negatively affects knowledge contribution. • Perceived knowledge quality negatively affects knowledge contribution.	• Participation • Organizational Culture • Knowledge Integration
Kankanhalli et al. (2005a)	Antecedents of contributions to knowledge repositories	Field study (interviews, survey)	Interviews: senior executives from 17 organizations; survey: 150 knowledge management practitioners from 10 organizations Singapore-based public organizations	• Loss of knowledge power is not a significant detriment to knowledge contributions to know ledge repositories. • Perceived codification effort is limited by generalized trust. • Perceived codification effort is not contingent on pro-sharing norms and identification. • Organizational reward affects contribution positively directly and contingent on identification. • Image building is no motivator for contributions to knowledge repositories. • Under conditions of strong pro-sharing norms, the need for reciprocity is lessened. • Self-efficacy and enjoyment of helping others strongly counts as contribution catalyst.	• Participation • Organizational Culture • Knowledge Integration
Kankanhalli et al. (2005b)	Antecedents to seeking from knowledge repositories	Survey	160 knowledge management practitioners of 8 government-related organizations from 6 industries Singapore-based public organizations	• Perceived output quality of knowledge repositories is a predictor for knowledge seeking from knowledge repositories. • For low task tacitness, KR availability strongly determines knowledge seeking from it. • Under conditions of high task interdependence, incentive availability is a predictor of knowledge seeking from knowledge repositories.	• Participation • Organizational Culture • Knowledge Integration

Poston, Speier (2005)	Impacts of content ratings and validity on knowledge sourcing	Laboratory study	Experiment 1: 51 undergraduate students; experiments 2-4: 108 undergraduate students Midwestern U. S. -based university	• Degree to which content ratings reflect information quality determines information seeking, in turn influencing decision-making quality. • High quality anchoring occurs with high validity ratings, low quality anchoring with low validity ratings; some raters adjust away from anchors. • Decision-making quality is highest for anchoring on high validity and lowest for anchoring on low validity without adjustment. • Collaborative filtering accounts as acredibility filter; number of raters and rater expertise do not.	• Participation • Organizational Culture • Knowledge Integration

Appendix Table 3. Networking-Related Empirical Studies

Author(s) (Year)	Field of Research	Method	Subjects and Location	Major Findings	KP Design Challenges
Chiu et al. (2006)	Social capital and social cognition in virtual communities	Survey	310 virtual community members of BlueShop Taiwanese virtual IT community	• Community-related outcome expectations determine knowledge sharing behavior in virtual communities; personal-related ones do not. • Social ties, reciprocity, and identification increase knowledge sharing in virtual communities, whereas knowledge quality does not. • Trust and common languages do not have an impact on knowledge sharing behavior in virtual communities.	• Participation • Organizational Culture
Cummings (2004)	External knowledge sharing of work groups and structural diversity	Field study (records, interviews, survey)	182 work groups of Fortune 500 telecommunications company Internationally operating firm	• Intra-group and external knowledge sharing positively affect group performance. • Influence of external knowledge sharing on performance is greater if groups are more structurally diverse.	• Knowledge-Integration
Hansen et al. (2005)	Inter-subset knowledge sharing	Survey	121 new product development teams from 27 subsidiaries of high-tech firm Internationally operating firm	• Density and frequency of intra-team relations negatively affects inter-subsidiary knowledge transfer. • Network range positively affects inter-subsidiary knowledge transfer. • Inter-subsidiary relation strength increases search costs but not knowledge transfer costs. • Perceived inter-subsidiary competition increases knowledge transfer costs. • Inter-subsidiary relation strength decreases knowledge transfer costs for tacit knowledge.	• Participation • Organizational Culture • Knowledge Integration
Levin, Cross (2004)	Dyadic knowledge transfer in social networks	Survey	127 employees, 3 firms from 3 industries U. S. -based, British, and Canadian firms	• Strong ties account for knowledge transfer but are mediated by trust. • Strong ties do not account for knowledge transfer of distinct knowledge type. • Under constant conditions of trust, weak ties account more strongly for knowledge transfer.	• Participation • Organizational Culture • Knowledge Integration
Lin, Lee (2006)	Socio-technical factors and knowledge sharing	Survey	154 senior executives from various backgrounds Taiwanese firms	• Managers having a positive perception of knowledge sharing are more likely to encourage it. • Pro-social organizational climate enhances knowledge sharing. • IT support has no significant effect on knowledge sharing.	• Participation • Organizational Culture
Patnayakuni et al. (2007)	Integrative practices and knowledge integration across boundaries	Survey	Mid-level managers from IS departments in 110 randomly selected firms	• Knowledge integration across knowledge boundaries improves IS development performance. • Formal and informal organizational integrative practices enhance the integration of specialized knowledge within and across subunits. • The positive influence of formal and informal integrative practices on IS development performance is partially mediated by knowledge integration.	• Knowledge Integration

Reagans, McEvily (2003)	Network cohesion and range and knowledge transfer	Survey	102 employees of research and development firm Midwestern U. S. -based firm	• Social cohesion facilitates knowledge transfer. • Network range facilitates knowledge transfer. • Tie strength is not predictive for the ease of transferring different types of knowledge. • Tacit knowledge is harder to transfer than explicit knowledge under conditions of constant tie strength.	• Participation • Organizational Culture • Knowledge Integration
Robert et al. (2008)	Social capital and knowledge integration in digitally enabled teams	Laboratory study	172 junior-level business school students in 46 teams U. S. -based universities	• Knowledge integration in teams is promotive to team performance. • Social capital has a strong influence on knowledge integration in teams. • Structural and cognitive capital play an increased role in digitally enabled teams.	• Knowledge Integration
Sarker et al. (2005)	Antecedents of knowledge transfer in virtual teams	Survey	96 IS development students from 12 teams U. S. -based and Norwegian universities	• Knowledge transfer in virtual teams is contingent on the contributor's credibility and their intensity of participation. • Knowledge transfer in virtual teams is not contingent on the contributor's capability.	• Knowledge Integration
Tiwana, Bush (2005)	Continuance in expertise-sharing networks	Survey	122 members of 4 expertise-sharing networks Internet networks	• Postadoption irretrievable investments in expertise-sharing networks are constituted of relational capital and reputation. • Personalization has a negative effect on continuance intention. • Personalization has the strongest effect on continuance intention, followed by user satisfaction, relational capital, and reputation.	• Participation • Organizational Culture
Wasko, Faraj (2005)	Impact of social capital on knowledge contribution in electronic networks of practice	Field study (usage data)	173 participants of electronic network of practice of legal professional association U. S. -based association	• Perceptual increase of professional reputation is a knowledge contribution antecedent. • There is weak evidence that people who enjoy helping others contribute more useful knowledge. • Intrinsic motivators only weakly influence knowledge contribution behavior. • Social capital influences contribution behavior, most significantly structural capital. • Relational capital has no effect on knowledge contribution behavior in networks of practice.	• Participation • Organizational Culture
Zboralski (2009)	Antecedents of knowledge sharing in communities of practice	Survey	122 members of 36 communities of practice within multinational firm Internationally operating firm	• Community leaders and management support predict interaction quality. • Interaction is driven by personal profit, mainly derived from intrinsic motivators. • Individuals participate if it helps their current projects, networking, and career progress. • Passing on knowledge and knowledge sharing as such are not objectives of members of communities of practice. • Individual motivation does not predict interaction quality.	• Participation • Organizational Culture

Appendix Table 4. General KMS-Related Empirical Studies

Author(s) (Year)	Field of Research	Method	Subjects and Location	Major Findings	KP Design Challenges
Alavi et al. (2005)	Influence of organizational culture on KMS usage and deployment	Case study	High-tech firm Internationally operating firm	• Local values will lead to unleveled usage of standardized KMS. • Diverse features of KMS will be used according to embedded cultural values. • Cultural differences will evoke differences between individual and organizational outcome of KMS usage. • In the presence of multiple cultures within one firm, bottom-up and top-down processes are likely to occur simultaneously.	• Participation • Organizational Culture • Knowledge Integration
Benbya (2006)	Antecedents of KMS effectiveness	Field study (firm records, interviews, survey)	10 interviews with knowledge managers from 10 knowledge-intensive firms, survey forwarded to subject matter experts (number not specified) Silicon Valley, U. S. - based firms	• Trust does not account as KMS usage or quality factor. • Senior management support fuels KMS usage both directly and contingent on identification. • Socialization fuels the interrelation of management support and identification. • Socialization has no effect on KMS usage. • KMS integration is a strong predictor for KMS usage and quality, yet it is a major challenge. • KMS accessibility is a strong predictor of KMS usage and quality, even more so on condition of KMS integration. • Knowledge quality leads to usage and perceived benefits.	• Participation • Organizational Culture
Bock et al. (2005)	Antecedents of knowledge sharing	Survey	154 knowledge and information managers from 30 public organizations in 16 industries Korean public organizations	• Extrinsic rewards are counter-productive to knowledge sharing intention. • Reciprocity is decisive for knowledge sharing. • Subjective norms have positive impact on knowledge sharing intention and attitude. • Fairness, innovativeness, and affiliation as aspects of organizational climate account for subjective norms and positive knowledge sharing intention. • Knowledge sharing ought not be forced or mandated.	• Participation • Organizational Culture
He, Wei (2009)	Antecedents of continuous knowledge contributing and seeking	Field study (survey, KMS usage data)	161 knowledge contributors, 201 knowledge seekers from 3 units of IT company Internationally operating	• Habit strongly moderates both KMS usage intention and factual usage. • Organizational conditions tend to affect knowledge contributing more strongly than knowledge seeking (in particular, management support). • Social relationships play a role not only for knowledge contribution but also for knowledge seeking. • Knowledge growth does not account as a motivator for knowledge seeking behavior (in a corporate setting). • Reciprocity does not account as a contribution antecedent.	• Participation • Organizational Culture • Knowledge Integration

Hwang, Kim (2007)	Internalization and identification in knowledge sharing	Survey	411 undergraduate students Northern U. S. -based university	• Internalization and identification strongly account for electronic knowledge sharing. • Collectivistic culture is fully mediated by internalization and identification.	• Participation • Organizational Culture
Janz, Prasarnphanich (2009)	Autonomy of teams in cooperative learning and knowledge integration	Survey	206 IS development workers from 38 teams and 13 productand service-related Fortune 500 companies U. S. -based and Canadian firms	• Autonomy of teams accounts for higher levels of cooperative learning. • Cooperative learning can be divided in three subcategories (group process, promotive interaction, and positive interdependence), having different results on fundamental goals of work satisfaction and performance. • Positive interdependence accounts for satisfaction, group process for work performance.	• Knowledge Integration
Kulkarni et al. (2006)	KMS success model	Survey	111 midlevel managers enrolled in MBA program at large urban university U. S. -based university	• KMS quality and knowledge content quality are determinants for KMS usage. • Enhanced supervisors, coworkers, leadership, and incentive enhance KMS usage both directly and indirectly (directly for incentive and leadership). • Overall user satisfaction with KMS (itself determined by KMS and content quality) positively affects KMS usage. • Perceived usefulness of knowledge sharing enhances KMS user satisfaction.	• Participation • Organizational Culture • Knowledge Integration
Lin, Huang (2008)	Social cognitive / task technology fit for KMS	Survey	192 IS employees from various hierarchical backgrounds and industries Taiwanese firms	• Task interdependence is positive related to KMS usage. • Task tacitness is negatively correlated to task-technology fit. • Personal outcome expectations are positively correlated to KMS usage. • KMS self-efficacy strongly accounts both for KMS usage and outcome expectations.	• Participation • Organizational Culture
Malhotra, Galletta (2005)	Influence of user commitment on volitional IS adoption and usage	Survey	179 respondents, participants of collaborative IS in healthcare organization Midwestern U. S. -based firm	• A model of volitional IS usage behavior comprising internalization, identification, and compliance (i.e., user commitment) as influence factors beside system quality can explain participation decisions. • User commitment influence usage intention directly during usage phase and indirectly via user attitude during adoption phase; internalization and identification have positive effects, compliance a negative one. • Perceived ease of use accounts indirectly for system adoption decision via the user's attitude • Perceived usefulness predicts system adoption and usage intention and is continuously enhanced by identification and internalization.	• Participation • Organizational Culture
Marks et al. (2008)	Managerial prompting	Laboratory study	76 undergraduate students from 2 universities U. S. -based universities	• Repeated managerial prompting leads to an increase in knowledge sharing.	• Participation • Organizational Culture

Patnayakuni et al. (2006)	Knowledge integration and process formalization in IS development	Survey	Representatives from 60 organizations being clients of operating software vendor firm	• Collaboration integrating tacit knowledge positively impacts systems development performance. • Explicit knowledge integration across different phases of the systems development process positively impacts performance. • Formalization of processes (establishing routines and discipline) accounts for performance gains. • Effects of collaborative exchange are positively/of explicit knowledge integration are negatively moderated by the formalization.	• Knowledge Integration
Quigley et al. (2007)	Motivational factors for dyadic knowledge sharing	Computer-based simulation	Undergraduate students, 120 participants U. S. -based Mid-Atlantic university	• Knowledge sharing can be better determined if norms and incentives are conceived interactively. • Isolated incentives cannot account for knowledge sharing; group incentives are more adequate than individual incentives; combination of incentives with norms has strongest impact on knowledge sharing. • Knowledge sharing accounts for personal goal-setting and thus performance.	• Participation • Organizational Culture
Siemsen et al. (2007)	Incentives and knowledge sharing	Survey	280 respondents from 4 organizations (private and public) U. S. -based organizations	• Optimal incentive-setting is contingent on given linkages between workers. • In case of knowledge linkages, individual and group incentives are not antithetic but complementary for optimal outcome.	• Participation