Running Head: Trajectories of Knowledge

Valuing Multiple Trajectories of Knowledge: A Critical Review and Agenda for Knowledge Management Research

William C. Barley

Department of Communication

University of Illinois at Urbana-Champaign

barley@illinois.edu

Jeffrey W. Treem

Department of Communication Studies

University of Texas at Austin

Timothy Kuhn

Department of Communication

University of Colorado Boulder

Pre-print version of:

Barley, W.C., Treem, J.W, & Kuhn, T.R. (2018) Valuing Multiple Trajectories of Knowledge: A Critical Review and Research Agenda for Knowledge Management Research. Academy of Management Annals, 12(1), 278-317. doi: 10.5465/annals.2016.0041

Acknowledgements: The authors would like to acknowledge the editors and reviewers for their thoughtful comments as this work developed. The first author would also like to thank William Ocasio for the valuable guidance and feedback he provided on early versions of this manuscript.

Abstract: Over the past three decades, scholars have increasingly come to view knowledge as one the most important resources necessary for successful organizing in the contemporary socio-economic landscape. In our vigor to understand how organizations may harness the diverse knowledge available to them, however, we have produced a disparity in our theories of knowledge management (KM) processes. By reviewing 20 years of influential KM literature, we uncover a bias toward explaining knowledge integration over research exploring processes of knowledge differentiation. Through our review, we explain why such a pattern has emerged and build an argument for why understanding differentiation is an increasingly important charge for management and organizational scholars. We then advance three strategic directions for future KM scholarship, based on the notion that recognizing multiple knowledge trajectories can aid in addressing several significant lines of theorizing in management and organization studies.

Keywords: Knowledge-Based View of the Firm; Knowledge Management; Integration; Differentiation

Valuing the Multiple Trajectories of Knowledge in Organizations: A Critical Review and Agenda for Knowledge Management Research

The tension between integrated and differentiated knowledge has been central to organizational theory for the better part of a century. One of the fundamental advantages of a classic bureaucratic organizational structure is its capacity to support subunits whose differentiated knowledge, knowledge unique to their specialized role and position, enables the efficient distribution of organizational tasks (Galbraith, 1973; Weber, 1978) and exploration of opportunities to expand organizational knowledge (March & Simon, 1958). Alternately, integrated knowledge, that which is common among organizational subunits, can also facilitate important organizational process such as coordinating action (Cyert & March, 1963; Padgett, 1980a, 1980b), supporting organizational learning and adaptation (Nelson & Winter, 1982), and spurring innovation (Hayek, 1945; Nonaka, 1994; Nonaka & Takeuchi, 1995). Balancing the pressures governing movement toward these two knowledge states has proven to be one of the major challenges of contemporary organizing (March, 1991), and the need to manage this balance has become increasingly necessary as we move deeper into the knowledge economy (Bell, 1973; Drucker, 1994; Stark, 2009). Recognizing the centrality of knowledge in organizational practices, scholars developed a focus on knowledge management (KM) as an area of research primarily devoted to understanding the processes by which knowledge shifts from differentiated to integrated states to produce operational benefits (Davenport & Prusak, 1998; Spender & Grant, 1996; Szulanski, 1996).

It has become commonplace for organizations to engage in structural, technological, and relational interventions explicitly designed to harness knowledge to produce distinct value. These efforts are spurred by the belief that KM can allow organizations to leverage differentiated knowledge held by their employees, to integrate knowledge that may be ignored or which exists

outside the organization, to generate new knowledge, or to move and apply knowledge in ways that advance organizational goals. Given these operational goals, scholars frequently view KM as a strategic endeavor: a plan of action that organizations pursue based on the conviction that managing the flow of knowledge can create value (Davenport & Prusak, 1988; Wiig, 1997).

Yet, the processes governing the production, flow, and maintenance of organizational knowledge have proven to be multiplex. Knowledge can reside in multiple locations, including individuals, bodies, routines, technologies, and practices (Blackler, 1995; Collins, 1993; Nelson & Winter, 1982), which creates challenges when attempting to make sense of which mechanisms are important in a specific organizational context. Further, knowledge is managed through a variety of social and technical processes. Individuals can share and produce knowledge through interaction (Kuhn & Jackson, 2008; Tsoukas, 2009), and embody knowledge through virtual tools (Vaast & Walsham, 2005; Wasko & Faraj, 2005). Organizations can codify knowledge in organizational routines and structures (Nelson & Winter, 1982), and develop new knowledge through specialization and strategic alliances (Lavie & Rosenkopf, 2006). In short, scholarly interests in KM include both revealing the mechanisms governing organizational knowledge and reflecting critically on how those mechanisms interact.

This manuscript reviews 20 years of influential KM research with three fundamental goals. Our first goal is to inductively develop a meta-theoretical framework for understanding how scholarship has examined the processes governing the trajectory of knowledge between integrated and differentiated states. Our second goal is to uncover any emergent patterns in how these processes have been emphasized in our literature. Finally, by taking stock of how we have approached KM, we seek to identify opportunities to extend KM research and to build an agenda for ongoing KM scholarship.

Our initial analysis produces a framework identifying four trajectories of knowledge in organizations, each governing a distinct flow of knowledge between integrated and differentiated states. We address our second goal by returning to KM literature to assess the prevalence of each trajectory in Management and Organization Studies (MOS) research. Our results show an imbalance in our theories of KM processes. We uncover a bias toward research explaining the mechanisms by which organizational subunits integrate diverse forms of knowledge over research exploring the mechanisms of knowledge differentiation. Finally, we consider the implications of such a bias for understanding organizational processes and performance. We offer three directions for future research that recognize the importance of, and offer a path for, studying multiple trajectories of knowledge in KM.

A Brief Introduction to Knowledge Management

It has become trite to assert that knowledge is a fundamental source of advantage for contemporary organizations. The post-industrial economy described by Bell (1973) is now an accepted reality exemplified by the ubiquity of, and dependence upon, information and communication technologies as a source and outcome of knowledge production (Castells, 2000). More than two decades ago, building on an emerging interest in the ways organizations could strategically manage knowledge, scholars like Grant (1996a, 1996b), Spender (1994, 1996), and Nonaka (Nonaka, 1994; Nonaka & Takeuchi, 1995) advanced knowledge-based views of firms. This work argued that the utilization of knowledge by individuals and organizations serves as the key driver of sustained competitive advantage (Grant, 1996b; Kogut & Zander, 1992; Okhuysen & Eisenhardt, 2002; Spender, 1996). The foregrounding of knowledge drew attention to *knowledge-intensive* organizations, which rely more on intangible assets, services, and human capital than the more traditional capital infrastructure, raw materials, and formal procedures (Starbuck, 1992). A knowledge-based view of the firm consists not of a single perspective, but is

comprised of a constellation of views regarding the function of knowledge in organizational contexts and the associated objectives and efforts to manage this knowledge. For instance, one knowledge-based view was an extension of the resource-based view of the firm (Barney, 1991; Penrose, 1959) and foregrounded knowledge as the essential resource providing firms value. An alternate view focused on the ways in which firms were constituted by the actions of individuals creating and applying situated knowledge (Nonaka & Takeuchi, 1995; Spender, 1996). Despite varying views of how knowledge is enacted in organizations, these scholars all positioned the management of knowledge as a critical challenge, and opportunity, for organizations.

In recognizing the strategic value of knowledge, this early work sparked problem-oriented inquiry into the practices that would cause an organization to be successful in managing knowledge. This line of inquiry is now referred to as KM. Managing knowledge became viewed not only as something that organizations do organically, but a distinct domain of management subject to investments of technology, human capital, and financial resources (Alavi & Leidner, 2001; Davenport & Prusak, 1998; Empson, 2001; Grover & Davenport, 2001). KM developed as an umbrella term for a variety of processes, practices, and artifacts present in organizational contexts (Alvesson & Kärreman, 2001; Teece, 1998) designed to derive value through the application and utilization of knowledge. The questions for analysts then turned to the conceptions of knowledge characterizing these activities, as well as the dynamics of the processes by which KM is enacted. We take these up in the next section.

Plurality in Definitions of Knowledge

Although scholars have largely accepted the importance of KM, there is tremendous diversity in definitions of knowledge (For discussion of typologies of knowledge see Alavi & Leidner, 2001; Blackler, 1995). For some, knowledge is equated with information, with the

primary distinction being that knowledge can exist solely in the minds of individuals (Alavi & Leidner, 2001; Gorman, 2002). Nonaka (1996) advances the epistemological stance that knowledge is "justified true belief." Though this view can position knowledge as a commodity that can be represented and shared with others (Grant, 1996b), it also enables a dynamic view of knowledge in that individuals vary in their personal beliefs and acceptable justifications. Alternatively, knowledge has been defined in terms of the ability to take action in a particular context (Mason & Apte, 2005; Orlikowski, 2002). Broadly, differences in views of knowledge can be characterized by their positions on three interrelated attributes: a) whether knowledge is explicit, b) where knowledge resides, and c) how knowledge is enacted.

Perhaps the most prominent distinction regarding the nature of knowledge is between explicit knowledge, which can be codified and represented in some material form, and tacit knowledge, which is intangible and tied to a specific context. Explicit knowledge can be externalized from individuals through the use of symbols, objects, and language in a manner allowing transmission or display to others. Alternatively, tacit knowledge refers to things people know and apply in action, yet find difficult to articulate and share (Polanyi, 1966). Tacit knowledge is developed through socialization, experience, and situated practice in a specific context – and individuals may not even be aware they are using this knowledge. The recognition that some forms of knowledge can be codified and articulated, yet others cannot, also means that knowledge can be viewed as residing both within and beyond individuals.

Organizational knowledge can be viewed as residing in a variety of contexts varying in their abstraction, visibility, and accessibility. For instance, Blackler (1995) notes that knowledge can be located in individuals' minds (embrained knowledge), bodies (embodied), organizational routines (embedded), dialogue (encultured), and symbols (encoded). Nelson and Winter (1982)

argue knowledge becomes located in the rules, routines, and procedures of organizations over time. At a more fundamental level, scholars differ in views of whether knowledge should always be viewed as residing with individuals (Grant, 1996b; Simon, 1997), or whether knowledge can belong to the organization (Hargadon & Fanelli, 2002; Nelson & Winter, 1982). Alternatively, others view knowledge as capable of moving from individuals to the organization such that it can be accessed or shared by others. This perspective captures an important corollary of the idea that knowledge can reside in different locations, which is that various forms of knowledge differ in the ease with which they can be accessed and moved (Grant, 1996b).

Additionally, perspectives diverge concerning whether knowledge is viewed as a static or dynamic resource or, put differently; should knowledge be viewed as *formed* in some manner or always in a state of *becoming*? Belying this distinction, scholars viewing knowledge as becoming, or enacted in action, often advocate an analytical focus on *knowing* as opposed to knowledge (Blackler, 1995; Kuhn & Jackson, 2008). The term knowledge tends to connote an object orientation: knowledge is something that does or can exist, and is something to which action can be directed. Knowledge, understood as a resource to be possessed by organizations and individuals, can be captured, created, transferred, stored, and retrieved. Alternatively, when the concern is *knowing*, the focus is on the actions individuals and groups take to meet their situated needs. This perspective views organizational knowledge as inextricably linked to the practices of individual workers as they seek to address emergent problems (Amin & Roberts, 2008). As we shall describe in greater detail below, when the analytical concern foregrounds knowing, knowledge is portrayed as always open to change and contestation.

This plurality of definitions produces both value and challenges for KM scholars. Though each perspective on knowledge is connected to distinct conceptualizations of how it can be

deployed to provide organizational benefits, this polysemy also produces analytic divides that make it difficult for scholars to generate insights across perspectives. Accordingly, in this manuscript we remain agnostic with respect to any specific definition of knowledge. To do otherwise would lead a review like ours to disregard swaths of the KM literature opting for an alternative view than any singular one chosen and, perhaps more importantly, to fail to recognize the multiple objectives served by KM activities. The goal of our review is not to assert a particular view of how knowledge should be conceptualized, but to observe how extant definitions of knowledge have shaped scholarly treatments of KM, and the related implications of these patterns. Our approach offers the potential to trace emergent patterns in the literature, and to develop a meta-theoretical framework acknowledging the multifaceted character of knowledge and knowing in organizational practice.

Reviewing Two Decades of Knowledge Management Research

We performed a structured literature review evaluating how knowledge management has been represented in influential scholarly work in MOS over the past twenty years. To do this, we sampled the ten most cited articles on KM for each year from 1996 to 2015. We chose 1996 as a meaningful start point because this year marked the publication of the now canonical special issue of *Strategic Management Journal* on Knowledge and the Firm coedited by Grant and Spender (Spender & Grant, 1996). This special issue marked one of the first collections of essays specifically aimed at *managing* knowledge to realize strategic organizational value; it was also an early effort to articulate the aforementioned knowledge-based theory of the firm. Although this sampling strategy provides an incomplete representation of literature discussing KM, we reasoned that it would characterize those studies that have had the greatest impact on scholarly thought in MOS over this era – and is consistent with our goal of evaluating the approaches to knowledge management that have garnered the most scholarly attention. This choice allowed us

to manage the challenge of reviewing a literature whose scope is well beyond what could be captured with any targeted effort.

We assembled our corpus using a Boolean search string in the Social Science Citation Index of Thompson Reuters' Web of Knowledge. For each year, we searched for articles whose title, abstract, or keywords contained any of the following key terms: "knowledge management," "knowledge sharing," "knowledge transfer," "knowledge differentiation," "knowledge integration," "knowledge process," "knowledge specialization," "knowledge flows," or "knowledge exchange." The outputs of these queries supported using 1996 as a start point, as this year marked the outset of a nearly monotonic increasing trend in the amount of KM research published each year (see appendix A for article counts by year). Next, we sorted each year's results by the number of times each article had been cited. We reviewed the top results for each year to ensure they expressed a primary interest in examining the processes by which knowledge flows within organizational contexts. We excluded articles that did not meet this criterion, replacing them with the next most cited article for that year. For example, we excluded multiple articles from the biological sciences that looked at knowledge processes as they relate to human evolution. We continued this method until we selected ten sources for each year. Our final corpus contained a stratified sample of 200 articles published over the past 20 years. The sample consisted primarily of empirical (126) and theoretical (65) papers with a smaller subset of reviews, simulations, and meta-analyses (9).

Next, we reviewed each of these papers to characterize how KM was represented therein; i.e., how the research sought to discuss, represent, or analyze the integration or differentiation of knowledge. Each author read a subset of the total articles and engaged in a process of focused coding related to any mention of integration or differentiation of knowledge, then produced a

short memo for each paper reflecting the presence of knowledge integration or differentiation, and a longer memo summarizing the findings from the total group of articles. After an initial read of the literature, the authors met to discuss any emergent patterns or themes associated with views of KM represented in the articles. At this stage, we determined that characterizing studies through the binary of an integration or differentiation focus was too constraining and not reflective of how these knowledge processes were portrayed. Instead, KM integration and differentiation were presented as both (and simultaneously) outcomes and antecedents; they were also portrayed as both goals to be strived for and obstacles to be overcome.

To allow for a more nuanced characterization of the way knowledge processes were presented in the research, our next stage of analysis identified of what we termed *knowledge trajectories*, which described the extent to which integration and differentiation were viewed as the starting or ending states for a specific knowledge management process. We chose the term "knowledge trajectory" to demonstrate an intended dynamic of change or stasis. Allowing for such temporality implies that organizational knowledge can be either maintained or transformed, such that organizational knowledge that is integrated at T_0 may either remain integrated or may become differentiated at T_1. We reviewed our initial coding of the articles and identified four knowledge trajectories present in the literature: integration to integration, differentiation to integration, integration to differentiation, and differentiation to differentiation. In settings where *integration to integration* is the focus, individuals, groups, or units start with common or shared knowledge and the goal is the continuation of this mutual knowledge over time. Studies addressing *differentiation to integration* discuss ways that organizations seek to bring together disparate knowledge such that it is then shared and accessible by others. Conversely, *integration to differentiation* notes ways organizations might start with shared knowledge, and then

individuals or subunits develop specializations or distinct forms of knowledge. Finally, *differentiation to differentiation* addresses efforts to sustain, maintain, or protect specialized knowledge such that it remains distinct and not common to everyone. It is important to note that these trajectories are not at all mutually exclusive; complex organizational systems are likely to include all four within and across their units (see Dooley & Van de Ven, 1999; Poole, 2014).

After identifying the four trajectories, we revisited our corpus and coded each article in terms of the knowledge trajectories discussed in the research. Appendix A lists our sample of manuscripts and final coding assignments. Table 1 below displays each trajectory in relation to the tension between integration and differentiation and labels them in terms of the distinct process of knowledge management supported by each trajectory: *Maintaining Common Ground*, *Producing Common Ground*, *Maintaining Specialization*, and *Producing Specialization*. We see this model as a valuable device for understanding the myriad processes examined by scholars interested in KM. In one sense, then, our model resembles Malone et al.'s (1999) efforts to create a "process handbook," a useful lexicon to grasp knowledge dynamics in organizing. Beyond its function as a vocabulary, however, it provides a metatheoretical lens to capture and compare claims about trajectories in the substantial body of scholarship on knowledge and KM in MOS.

In the following sections, we outline the findings from research within each of the four quadrants of table 1. We start by explaining the dominant scholarly focus on the differentiation to integration trajectory represented in the second quadrant of the table. We label this quadrant *Producing Common Ground* to demonstrate the goal of bringing together diverse knowledge into some shared form. We summarize research within this vein and then explain why this trajectory received disproportionate scholarly attention in our sample.

Next, we review research within each of the three other trajectories. As noted earlier, one benefit of focusing on knowledge trajectories is that it suggests that multiple KM processes exist not in fundamental opposition to one another, but rather as alternative possibilities. Following Poole and Van de Ven's (1989) argument that acknowledging both sides of a theoretical paradox can be generative, we adopt the position that presumably oppositional forces, such as integration and differentiation, should be capable of co-existing dynamically with one another. Thus, it is important for us to maintain an awareness of how processes governing the three other trajectories play out in organizations. We demonstrate the value of this awareness by highlighting findings from research positioned in the remaining three quadrants of our model.

[Insert Table 1 About Here]

Differentiated to Integrated Knowledge: The Integration Bias

Our analysis indicates that the most influential KM scholarship over the past two decades emphasized the study of integrational trajectories over others – with 84.5% of papers in the sample including this as the focus. The primary reason for this seems to have been that bringing together disparate knowledge is frequently characterized as a central mechanism by which organizations can realize strategic benefits from available knowledge. This emphasis can be traced to the earliest works in the sample. Grant (1996a, p. 375), for example, argued that "if the strategically most important resource of the firm is *knowledge*, and if knowledge resides in specialized form among individual organizational members, then the essence of organizational capability is the integration of individuals' specialized knowledge." From a resource management perspective, advantages were portrayed as coming not simply from the possession of unique knowledge, but from the ability to integrate available existing knowledge to achieve

capabilities that no other firm possessed (Drucker, 1994; Nonaka, 1994). Topically, research in this quadrant examined interrelated phenomena at multiple levels of analysis.

Team level studies have emphasized the interactional, structural, and relational mechanisms leading teams to effectively integrate individual level knowledge into shared organizational knowledge (e.g. Bechky, 2003; Carlile, 2002; Gibson & Vermeulen, 2003; Levina & Vaast, 2005). Okhuysen and Eisenhardt (2002), for example, found that formal interventions could influence groups' capacities for sharing knowledge, showing that teams where members were prompted to interact more frequently experienced increased effectiveness at integrating their local knowledge in an analysis task. Levina and Vaast's (2005) study of boundary spanners at an insurance company and an internet consulting firm demonstrated the practices associated with brokering knowledge across intra-organizational boundaries, showing that only those individuals who actively negotiated relationships with diverse individuals realized the benefits associated with integrating diverse ways of knowing. At the heart of these studies, and others like them, is a recognition that teams that effectively integrate diverse forms of knowledge often realize measurable performance benefits (Carlile, 2004; Mesmer-Magnus & DeChurch, 2009).

Information technologies also played a central role in KM scholarship in this era, with scholars quickly recognizing that such systems offer the potential to both centrally store codified knowledge and to connect individuals with experts with relevant tacit knowledge (Alavi & Leidner, 2001; Davenport, De Long, & Beers, 1998). The belief that KM systems could offer beneficial integrative affordances remained despite evidence that early tools designed to become repositories of shared knowledge ultimately evolved into "information graveyards" with few contributors and fewer consumers (Bock, Zmud, Kim, & Lee, 2005; McDermott, 1999). Scholars argued that the integrative function of KM systems largely depended on motivating individuals

to contribute to such systems (e.g. Chang & Chuang, 2011; Kankanhalli, Tan, & Wei, 2005; Lin, 2007). Wasko and Faraj (2005), for example, showed that one of the major barriers to fostering integrative practices through KM systems arises because individuals tend to only contribute content when they perceive participation will provide them self-benefit. Without proper incentive, individuals tend to view participation in information systems as either wasteful or counterproductive (Vaast & Walsham, 2005). In recent years, studies of KM systems have shifted to examine the role that the social media technologies have played in fostering knowledge integration in organizations (Leonardi, 2014; Majchrzak, Faraj, Kane, & Azad, 2013), noting that even though many of these technologies may fail to directly capture tacit knowledge, they can play a role in making knowledge of who knows what visible in ways that help individuals seek out others (Leonardi, 2007; Leonardi & Treem, 2012; Yates & Paquette, 2011).

Network studies have examined the structures associated with integrating local knowledge into organizational knowledge (Cummings, 2004; Fleming, Mingo, & Chen, 2007; Hansen, Mors, & Løvås, 2005; Inkpen & Tsang, 2005; Singh, 2005). A recurrent finding in this work is that actors who are positioned in structures offering access to diverse knowledge tend to exhibit comparatively higher performance with respect to idea generation (Burt, 2004), the novelty of their inventions (Fleming et al., 2007), or the impact of scholarly outputs (Uzzi, Mukherjee, Stringer, & Jones, 2013). By connecting multiple bodies (and practices) of knowledge, such individuals seem capable of integrating disparate knowledge.

At a macro level, studies have examined the factors leading to knowledge transfer in alliances and joint ventures (e.g. Ireland, Hitt, & Vaidyanath, 2002; Oxley & Sampson, 2004; Sampson, 2007). We see an integrational motivation here again, with such ventures being characterized as opportunities for an organization to access and utilize its collaborators'

knowledge to its own benefits. This line of scholarship recognizes that firms and groups differ in their abilities to capture, integrate, and apply knowledge from diverse sources (Cohen & Levinthal, 1990; Volberda, Foss, & Lyles, 2010).

Explaining the Integration Bias. Our analysis uncovered several patterns that explain why this integrational emphasis materialized. Specifically, we argue that conceptualizations of tacit knowledge as a barrier to performance, a perspective viewing value as produced in the (re)combination of previously distributed resources, and an emphasis on meeting organizations' perceived operational needs, have all driven this trend.

Need to utilize tacit knowledge. The existence of tacit knowledge has emerged as one of the key impediments to realizing a central tenet of effective KM in organizations: "knowing what we know." Michael Polanyi (1961, 1962, 1966) introduced the term tacit knowledge to recognize that not all knowledge is created equal, nor is it manifest in similar ways. While some forms of knowledge are easily codified and transferred, others are embedded within experience and practice. This distinction reveals a fundamental tension for organizations hoping to derive value from perceived knowledge resources. If knowledge is always tied to practice, then it is difficult for that knowledge to exist outside of a finite context or the experience of individuals immersed in practice. As such, research often characterizes tacit knowledge as the "problem" requiring solution (Cramton, 2001; Sole & Edmondson, 2002; Zack, 1999). For example, KM scholars recognized that tacit knowledge was among the chief factors leading to knowledge being "sticky" inside organizations (Brown & Duguid, 2001; Dougherty, 1992; Osterloh & Frey, 2000; Szulanski, 1996, 2000) and therefore difficult to move or extract.

KM research has frequently addressed mechanisms by which tacit knowledge may be transferred to others or converted into codified forms. For instance, collaboration and knowledge

sharing research has examined how differing communities can share knowledge across boundaries of practice (Carlile, 2002; Wenger & Snyder, 2000), largely revealing that sharing tacit knowledge requires active engagement and cross-boundary dialogue (Amin & Roberts, 2008; Carlile, 2004; Levina & Vaast, 2005; Wang & Noe, 2010). This engagement often takes place in communities of practice (Brown & Duguid, 1991; Iverson & McPhee, 2002) where individuals engage in similar tasks and roles, and can share knowledge, observe each other, and learn the tacit knowledge needed to operate as a competent member of an organization. Others have considered ways that individual tacit knowledge can be transformed or converted into a more explicit form and made available to others in an organization (Nonaka, 1994). This goal of externalizing tacit knowledge is a key driver of the implementation of KM technologies intended to facilitate broader availability of individual level knowledge as a resource available across the firm. However, research on KM systems has shown that traditional strategies for capturing and cataloging knowledge are often ineffective for sharing tacit knowledge because it is difficult for individuals to externalize this knowledge in a way that it would be contextually useful (Ackerman, Dachtera, Pipek, & Wulf, 2013; Huysman & de Wit, 2004; McDermott, 1999).

Emphasizing the (re)combination of diverse knowledge. Another theme that emerged was a prevailing view of the (re)combination of preexisting knowledge as a fundamental source of organizational benefit (Gertler, 2003). Specifically, integrating diverse knowledge resources is often seen as significant predictor of the likelihood of innovative outcomes. This viewpoint descends largely from Schumpeter's (1934) recognition that competitive advantages are often gained through the application of previously existing capabilities in new contexts. This perspective toward knowledge and innovation is readily visible in definitions of knowledge creation throughout the literature such as the following from Inkpen and Dinur:

> Clearly, organizations are repositories of knowledge. The important question is how individual and group interactions contribute to organizational knowledge creation. Organizations cannot create knowledge without individuals, but unless individual knowledge is shared with other individuals and groups, the knowledge will have a limited impact on organizational effectiveness. Hence, organizational knowledge creation should be viewed as a process whereby the knowledge held by individuals is amplified and internalized as part of the organization's knowledge base. (1998, p. 456)

This definition implies that the key problem organizations face is not one of creating *new* knowledge (in the sense of creating something that *never* existed previously), nor is the problem one of maintaining a knowledge diversity across a workforce. Rather, the issue to be managed is one of integrating preexisting individual-level knowledge to realize unrecognized organizational benefits. Research in our sample emphasized the processes by which organizations connect and foster knowledge exchange from diverse sources. Practice oriented research showed that teams taking explicit efforts to connect with others produce more effective innovations (Hargadon, 2003; Hargadon & Sutton, 1997), and network oriented research demonstrated that bridging multiple information sources increases the propensity for individuals or organizations to produce impactful outputs (Breschi & Lissoni, 2009; Burt, 2004; Fleming & Singh, 2010; Phelps, 2010)

Diverse knowledge is often treated as the initial condition upon which studies of knowledge in organizations begin. Relatedly, knowledge asymmetry is characterized as a consequence of the increasing prevalence of white collar work that favors specialized or esoteric work (Drucker, 1994; Sharma, 1997), and theories of group interaction assume that individuals will divide responsibilities for knowledge domains and related tasks over time (Brandon & Hollingshead, 2004; Wegner, 1987). These perspectives assume a natural entropy towards the specialization and separation of knowledge among organizational members, and implicitly or explicitly position this as a challenge to be addressed (Argote & Ingram, 2000).

Operational values. It is important to recognize we are not claiming that scholars have been misguided in their research objectives. The research in our corpus offers abundant evidence

that integrational processes are critical for effective KM. In fact, the measurable benefits associated with integration are likely one of the strongest reasons this trajectory has emerged as the dominant object of inquiry for KM. Of the four trajectories, integration seems to be the most clearly linked to measurable performance benefits, especially at short temporal spans. The ability to identify, measure, and develop practices around integration all help explain the common focus on integration in KM scholarship.

From a practical standpoint, many firms also seem to consider integration to be the KM trajectory that provides them with the most difficulties. This was particularly true during the era when the KM field was first developing. Firms in the 1990's were firmly rooted in the shift to a post-industrial economy (Drucker, 1994), globalization was a growing phenomenon (Friedman, 1990), and information technology was beginning to provide organizations with access to sources of knowledge beyond previous comprehension. The issue at hand was not one of *creating* something new, but of taking advantage of the vast resources sitting there for the taking. Titles of a number of early KM manuscripts such as "If only we knew what we know" (O'Dell & Grayson, 1998), and "Embedded firms, embedded knowledge" (Lam, 1997) belie this viewpoint. Ruggles (1998) surveyed 431 CEOs and showed that the leadership of most organizations viewed integration as their primary problem. One striking finding from Ruggles' analysis was that the least prominent issue reported by respondents was *creating new knowledge.* Rather, CEOs saw the problems of managing knowledge as primarily including issues of transferring, capturing, and embedding pre-existing knowledge documentation. As Alavi and Leidner (2001, p. 108) argued, "It is less the knowledge existing at any given time per se than the firm's ability to effectively apply the existing knowledge to create new knowledge and to take action that forms the basis for achieving competitive advantage from knowledge-based assets."

Another influence on the focus on integration is the tendency for KM scholarship to emphasize knowledge outputs, such as the production, addition, or combination of knowledge that are accessible to multiple organizational actors. In many respects, differentiation is characterized as the absence of shared knowledge outputs. Adopting an integration focus allows scholars to look at how strategic KM initiatives alter performance in organizational contexts (Dyer & Nobeoka, 2000). This is done both within organizations related to how teams and groups integrate knowledge, as well as at the organizational level related to the formation of organizational alliances (Lam, 1997; Lane, Salk, & Lyles, 2001; Zucker, Darby, & Armstrong, 1998). A review of KM literature in the field of information systems found that a clear majority of studies had adopted a normative focus on the ways the presence and use of KM technologies influenced the performance of organizations, individuals, or units (Schultze & Leidner, 2002). Because the use of KM systems in any collective or shared sense is likely to promote the integration, and not differentiation, of knowledge, the increased interest in how KM technologies relate to performance outcomes also perpetuates an integration bias.

Calls to Consider Alternative Trajectories in KM Research. Although integrational research dominated our sample, a parallel set of theorists have argued for more dynamic perspectives on KM (Venkitachalam & Willmott, 2017). Early review papers emphasized that integration was only one component of a complete KM strategy, recognizing that knowledge creation and knowledge protection also played important roles in the dynamics of knowledge within and between organizations (e.g. Demarest, 1997; Wiig, 1997). Bontis (1999, p. 436) argued that the concept of knowledge creation, which he conceptualized as the discovery and production of differentiated knowledge, had been “virtually neglected even though Nonaka and Takeuchi (1995) are convinced that this process has been the most important source of

international competitiveness for some time." De Long and Fahey (2000) argued that one of the reasons that many KM efforts were met with failure was due to an overemphasis on processes of codification and transfer that lacked recognition for the dynamic nature of knowledge in organizations. Tsoukas, too, has long criticized KM research failing to account for the importance of locally differentiated and performed knowledge in day-to-day work practices (Tsoukas, 2009; Tsoukas & Vladimirou, 2001). Others have argued that KM scholarship has paid little attention to mechanisms by which organizations create *new* knowledge across and within different organizational units (Argote & Miron-Spektor, 2011), and claimed that terms like "knowledge creation" are often treated as an outcome of integrating previously isolated bodies of knowledge as opposed to the generation of something novel (Phelps, 2010).

Our four-trajectory framework offers a conceptual lens with which to characterize these critiques. Although operational benefits may readily emerge from developing KM processes emphasizing the production of common ground, focusing solely upon those processes overlooks the potentially important role that the other three trajectories play within organizational systems. Our review suggests that although the other three trajectories are less frequently represented in the literature, they nonetheless encompass organizational processes that are vital to sustaining ongoing organizational performance. We now turn to research in the remaining quadrants of our model to illuminate the value of these alternate processes.

Integrated to Integrated Knowledge: Maintaining Common Ground

The trajectory captured in the upper-left quadrant of Table 1 portrays KM as the practice of sustaining integrated knowledge over time. We labelled this quadrant *Maintaining Common Ground* because it describes processes in which organizational units begin with a body of shared knowledge and enact problem-focused action to preserve that communal knowledge. This

trajectory was least represented in our corpus, appearing in just 8% of our sample, and is largely present in studies that discuss the maintenance or perseverance of partnerships (Beckman, Haunschild, & Phillips, 2004; Malhotra, Gosain, & El Sawy, 2005), relationships (Im & Ray, 2008; McFadyen & Cannella, 2004), or collaborations (Fleming, Mingo, & Chen, 2007). Maintaining common ground is viewed as a means of retaining or protecting existing knowledge resources available among multiple actors.

There are several potential organizational benefits associated with maintaining common ground. Looking beyond the most influential articles we can see how this knowledge trajectory can play important roles in fostering coordination across multiple sub-units or domains (Okhuysen & Bechky, 2009), facilitating effective decision making (M. D. Cohen, March, & Olsen, 1976; Padgett, 1980b), and managing organizational identities and boundaries (Aldrich, 1971). A few illustrations will help demonstrate the value associated with this type of process. First, Bruns's (2013) ethnographic account of systems biologists engaged in cancer research located a variety of practices enabling team-level coordination and collaboration. Though these scientists hailed from multiple disciplines, they took explicit efforts to maintain a common interpretation about their tasks. Maintaining this interpretation allowed the scientists to see their efforts as aligning with an overarching goal, even when working apart from one another. Actively managing this shared knowledge facilitated the complex coordination necessary to facilitate an effective collaborative relationship over time. Second, Bechky's (2006) study of role-based coordination in film projects showed that a generalized role structure travels across projects, producing the coordination and continuity that enable each ad hoc system to materialize. Role structures are not, however, static and pre-existing objects existing apart from practice; instead, they are interactively (re)constituted within and across projects through distinct

practices like interpersonal thanking, admonishing, and joking. Both studies demonstrate how maintaining a relatively small set of common epistemic objects across sub-unit boundaries (Rheinberger, 1997) can facilitate commensurate action in contexts that would otherwise break down into conflict or chaos. The common ground maintained in these studies was not a shared set of information or beliefs about some object, but an understanding of roles in a system comprised of heterogeneous roles.

A similar claim is advanced in Huber and Lewis's (2010) theoretical discussion of "cross-understanding," in which group members' grasp of other members' mental models. This concept is associated not with a division of cognitive labor, but with collaboration, the surfacing of task-relevant information, and member learning—all of which, in turn, shape group performance. Groups can maintain common ground through shared meta-knowledge regarding who knows what. In this situation, which is represented in transactive memory systems, the organization or group strives to construct a shared directory of the knowledge of organizational members, and seeks to update and maintain that directory as new knowledge enters the system or the group demands change (Lewis, Lange, & Gillis, 2005; Wegner, 1987). Importantly, maintaining this common meta-knowledge requires ongoing efforts in the form of group interaction and communication (Hollingshead, Brandon, Yoon, & Gupta, 2010). Cross-understanding, like the empirical cases presented in the preceding paragraph, suggest that *Maintaining Common Ground* is not about replicating knowledge, as would be the case if integration meant that each individual's cognitive content becomes isomorphic by T_1. Instead, when the unit of analysis is a collective—a team, group, project, or organization—this trajectory highlights how a collective's task performance *reinforces* its approach to generating harmonized

action. Knowledge of the task, of the role structure, of others' knowledge, of how to generate coordination, all remain integrated as a result of conjoint activity.

Differentiated to Differentiated Knowledge: Maintaining Specialization

The third quadrant contains a trajectory we call *Maintaining Specialization*, which was present in nearly one-fourth (23%) of all articles and was the second most prevalent trajectory after *Producing Common Ground*. This movement starts with a condition of differentiated knowledge but, instead of creating integrated knowledge or common ground, upholds the divergent knowledge characterizing the organizational unit. Organizational theory has long argued that such processes are logically necessary: If organizations require specialization to interact with, and adapt to, complex environments, KM processes should not be expected (or intended) to result in integrated knowledge in every case (March & Olsen, 1976; Padgett, 1980a, 1980b). *Maintaining Specialization* speaks to the desire to retain differentiation across tasks and time. Differentiation allows organizations to retain a wider array of knowledge (Bock, Zmud, Kim, & Lee, 2005; Lavie, Steiner, & Tushman, 2010) and to protect distinct forms of knowledge providing them competitive advantage (Oxley & Sampson, 2004). Alternatively, maintaining specialization may be advantageous when the required work to maintain common ground among groups is too costly (Carlile, 2002).

A body of work that demonstrates this process is found in the motivated information sharing literature. This work acknowledges that the tasks facing groups frequently elicit mixed (and even conflicting) motivations among group members, leading them to pursue varied approaches to searching for, and processing, information. Group discussions, particularly when working on a hidden profile task (where some information is shared and some is unshared by group members, and no member can determine the best group decision prior to the interactive

pooling of information), tend to elicit shared information to the detriment of the unique information possessed by individuals (Stasser & Titus, 1985). Studies following Stasser and Titus often depict motivated information sharing as a problem to be overcome; when the aim is to improve decision-making in this specific type of group task or to achieve the ends proffered by knowledge integration, a lack of member sharing may indeed be a concern. Some research, however, acknowledges that maintaining differentiation in group members' information can be functional for other (non-hidden profile) tasks and may serve group members' varying motivations (Brodbeck, Kerschreiter, Mojzisch, Frey, & Schulz-Hardt, 2002; Steinel, Utz, & Koning, 2010; Wittenbaum, Hollingshead, & Botero, 2004). Moreover, under certain conditions, groups that maintain specialization with respect to information may experience *increased* ideation and creativity (Bechtoldt, De Dreu, Nijstad, & Choi, 2010). This work recognizes that maintaining specialized knowledge through the withholding of information is an active process that has consequences for group performance. These processes begin with, and maintain, divergent knowledge; the point is not that group processes mold this into shared knowledge, but that diversity, managed well, can produce superior decision-making processes.

A second illustration of *Maintaining Specialization* comes from a rather different line of work. Bruni, Gherardi, and Parolin's (2007) explicitly practice-based perspective (see also Brown & Duguid, 1991; Cook & Brown, 1999; Kuhn & Jackson, 2008), position their view against conventional visions of knowledge as an item to be transferred:

> When we conceive knowledge as a substance, we see it materialized in objects; when we conceive it as a property, we see it as owned by individuals. When we look at knowing-in-practice, we define it as the mobilization of the knowledge embedded in humans and nonhumans performing workplace practices. (p. 85)

From this stance, Bruni et al. studied remote health care consultations, finding a system of *fragmented* knowledge. Knowledge, in this setting, was embedded in patients, the medical community, organizational rules and habits, artifacts, a technological infrastructure, and an organization; no single site eclipsed the others. The authors located practices that sometimes created a temporary alignment of actors in the conduct of remote consultations, but also could lead to the disruption and disturbance of practices, roles, and knowledge. Their point is that the *multiplicity* of heterogeneous elements must be mobilized and transformed in situated practice; the elements are related to one another, but the fragmented system never experiences complete integration (See also Gherardi & Nicolini, 2000; Hopwood, 2014). Research operating from this perspective must remain sensitive to the contingencies and practices through which temporary alignments—but not integrated knowledge—occur. This claim about the sensitivity to the contours of situations can also be seen in Faraj and Xiao's (2006) study of a medical trauma center, where teams employed different forms of coordination, based on expertise or dialogue, to address exigencies of the urgent situations. Across these two lines of thought on *Maintaining Specialization*, then, are claims that processes that retain or re-create differentiated knowledge can be functional for organizational practice.

Integrated to Differentiated Knowledge: Producing Specialization

Our final quadrant encapsulates a trajectory that is represented relatively rarely (in 12.5% of the sample) in the KM literature: *Producing Specialization*. Here, units begin with shared knowledge but, through particular processes, transform that integration into a modicum of differentiation. Although the production of specialization may at first glance seem to be counter to the common goals of KM, some research suggests that this type of process plays an important role in knowledge systems over time. Empirically, this is represented in work that shows the

value of firms developing specialized knowledge that allow them to act more efficiently in more domains (Brusoni, Prencipe, & Pavitt, 2001; Hansen, 2002). Knowledge may be available in a shared or communal form, and then be applied or developed by individuals or organizational units in novel ways to pursue specialized tasks (Majchrzak, et al., 2013; Tsoukas, 2009).

One perspective on this process draws upon differences between individuals and the systems in which they operate, portraying the increased specialization and division of labor across individuals as creating greater productive capacity for groups (Austin, 2003) and firms (Kogut & Zander, 1996). As individuals or units differentiate, the span of the environment that the organizational system, writ large, covers increases. In some work, the production of specialization is tied to the creation of new knowledge, as in DeLong and Fahey's (2000) conceptual argument about the importance of cultures that encourage debate and internal interrogation of existing assumptions, moves that can disrupt previously shared understandings but can, in time, create novel courses of action. At the level of interorganizational networks, the value of creating knowledge through specialization can be seen in Brusoni, Prencipe, and Pavitt's (2001) study of managers and designers in the aircraft engine control field. Noting that a division of labor and a division of knowledge refer to separate concepts, these authors suggested that, within networks of loosely coupled organizations, there are benefits to encouraging firms to develop more knowledge than that which is minimally necessary for their contribution to the product; this allows those firms to play a coordination role in the network.

An alternative perspective on *Producing Specialization* is evident in research that foregrounds the process of forgetting as a component of organizational learning. De Holan and Phillips (2004a, 2004b) explicate this view, arguing against the MOS literature's almost singular focus on the accumulation of new knowledge in defining organizational learning. They note that

organizational memories can be hindrances, rather than aids, to organizational performance (Anand, Manz, & Glick, 1998; Crossan, Lane, & White, 1999) and that advantages based on memories are likely to be more precarious than those based on more stable resources. The process of forgetting may be involuntary, a result of human limitations or a systemic inability to codify knowledge (Argote, 2012; Nonaka, 1994). Yet it is also often intentional, involving the construction of barriers that prevent past information from being included in ongoing routines, or it can consist of actively deleting or destroying elements of the present to clean the slate for the future (Bowker, 1997). Forgetting can, consequently, be functional in that it can lead to the creation of new routines and new forms of specialization that aid in ongoing action.

Summary

Our review of influential KM research over the past 20 years shows a disproportionate focus on a knowledge trajectory of differentiation to integration, yet the minority of literature recognizing other knowledge trajectories note a variety of potential benefits these divergent efforts support, and the ways multiple processes of knowledge are key to successful KM. Figure 1 illustrates the number of articles for each year in our sample that including each trajectory as an object of their discussion. Our coding scheme allowed for articles to represent multiple processes; however, most papers (118) exclusively studied integrational trajectories without discussing other mechanisms. This pattern was emphasized in empirical papers (with 85/126 explicitly on *Producing Common Ground*) and deemphasized in theoretical work (31/65). The downward slope in the integration line over the past decade potentially indicates an ongoing shift in scholarly thought toward a more representative mix in objects of analysis.

[Insert Figure 1 About Here]

It is important to recognize that our conclusions regarding the integration bias are bounded by the scope of our review. Our goal was not to assess the breadth of KM scholarship across all outlets and disciplines; instead, we sought to gauge what has garnered to most attention within MOS. This alongside our sampling method mean that we can only conclude the emphasis on integration has been present within the most highly cited articles on KM in MOS. Certainly there is a vast array of studies beyond this sample that have examined KM and emphasized trajectories beyond the production of common ground. In what follows, we build on such studies, looking beyond our corpus to lay out what we see as three fruitful directions forward for KM scholarship.

Transcending the Integration Bias: Strategic Directions for KM Research

Given the presence of the integration bias in studies of leading KM scholarship, our task now turns to considering how MOS scholarship might build upon the four trajectories to produce novel insights into organizations and organizing processes. Recognizing that the field's emphasis on integration has emerged from both a strategic and a practical motivation, any argument for the value of a more dynamic viewpoint on KM must preserve the operational goals that have driven MOS scholars' interest in knowledge for the past two decades. It would not be enough for us to simply claim that a dynamic approach to knowing in organizations offers a more ecologically valid characterization of how firms operate. Rather, we need an agenda of research that will demonstrate *how* considering knowledge differentiation in organizations can offer advantages over continuing to emphasize integration over other dynamics.

In this final section, we outline three different directions for ongoing research that we see as avenues for simultaneously broadening and reconciling the range of KM scholarship. Each approach explores how taking a dynamic perspective on knowledge and knowing can not only engage fruitfully with the complexity of knowledge, but also offer new strategic directions for KM research. Moreover, each approach argues for the benefit of incorporating multiple

trajectories as analysts' objects of analysis. First, we argue for a perspective considering how organizations can be mindful of *which* knowledge they share by considering the contexts where refraining from information sharing might offer organizations benefit. Next, we build an argument for how taking a situated and dynamic view of knowing can be applied to organizational benefit, and how doing so can offer pragmatic and action-oriented guidance for a variety of organizational types and contexts. Finally, we argue that viewing KM as processes of continuous organizational change can aid researchers in maintaining a focus on opposing forces and multiple trajectories of knowledge over time. Table 2 summarizes the research questions that become centralized by each of these approaches.

[Insert Table 2 About Here]

Acknowledging the Value of Uncommon Ground in (Not) Sharing Knowledge

Our first avenue forward begins from the premise that social processes that facilitate differentiation (the trajectories we called *Producing Specialization* and *Maintaining Specialization*) can play an important role in enabling the beneficial impacts of integrating diverse knowledge. Acknowledging differentiation is not to disparage the value of integration, but is a recognition that knowledge systems governed solely by integrational dynamics will quickly find themselves disadvantaged. Specifically, we argue that recognizing the important role of *uncommon ground* in KM requires us to ask less about how organizational units integrate knowledge and more about *which* knowledge *should* be integrated across organizational units. Such an analytic move may be conceptualized as building research spanning the left and right halves of Table 1.

The Carnegie School offers a point of departure for appreciating the reciprocal roles of differentiation and integration in KM systems. In this body of theory, organizational structures

and practices function to facilitate decision-making activities in a constantly shifting knowledge environment whose scale is beyond rational conception (Cyert & March, 1992; Gavetti, Levinthal, & Ocasio, 2007; March & Olsen, 1976; March & Simon, 1958; Simon, 1997). At the same time, each organizational unit is characterized by bounded rationality, which means each is limited in the scope to which it may attend at any moment in time. Given these constraints, one reason for the firm's existence is its capacity to enable attention to a wider swath of the environment than possible by any single individual (or unit). By dividing into specialized sub-units, firms spread their knowledge and create the potential for complex, efficient, and coordinated action. For the Carnegie School, differentiation and integration play different but equally important roles in enabling organizational action: differentiation facilitates exploratory processes which develop and expand the bounds of an organization's knowledge (March, 1991; March & Simon, 1958), and integration enables an organization to benefit from the knowledge it already possesses (Burt, 2004; Hayek, 1945; Ocasio, 1997; Padgett, 1980a, 1980b).

In a series of simulation models, March (1991) demonstrated how a disproportionate emphasis on either trajectory (in his terminology, exploitation or exploration) would result in the organization sinking into a local minimum in terms of performance. March's claim is echoed by Nonaka (1994), who held that effective KM involves managing the delicate balance between redundant knowledge and the requisite variety of sub-units' knowledge necessary to foster generative interactions. Grant (1996b) too recognized that common ground played an important role in fostering communication across boundaries, but argued that "the key to efficiency is to achieve affective integration while minimizing knowledge transfer through cross-learning by organizational members" (p. 114). In short, then, effective KM requires organizations to enact

coordination mechanisms that manage this tension and preserve the trajectories of both differentiation *and* integration.

Figure 2 illustrates this tension by showing how, when two organizational units interact, efforts favoring the development of integrated knowledge can produce the unintended consequence of minimizing the breadth of knowledge captured within the organizational system. Though the first two panels demonstrate how each unit's differentiated knowledge shrinks as overlap is produced, these panels also assume each unit maintains awareness of a consistent amount of knowledge in its environment over time.

[Insert Figure 2 About Here]

The third panel, in contrast, visualizes how organizational units might *simultaneously* cultivate common ground and specialization Managing the tension between these impulses is likely to require a good deal of additional effort (and resources) because each subunit must be aware of a larger portion of the knowledge environment (hence the expansion from circles to ovals in the Figure). In other words, avoiding the sacrifice illustrated in panel 2 (ignoring the knowledge environment in the interest of achieving greater overlap with the other unit) requires the ongoing enactment of differentiation *in addition to* integrational processes. Managing the tension requires work; any effective KM strategy must acknowledge that labor and support it.

What, then, are the processes that foster the organizational management of the integration-differentiation tension? Though rarely using the notion of KM, research in MOS has addressed this question. For example, Hutchins (1995), in an ethnographic study of navigation teams on aircraft carriers, showed how artifacts and routines can allow individuals to appropriate external knowledge without having to develop situated understandings in a new domain. A technician may be trained to effectively adopt an astrolabe, for example, without developing

deep familiarity with the underlying mathematical and astronomical knowledge that went into building such a tool. By taking advantage of the knowledge embedded within the tool, the individual is free to devote his or her attention to other efforts involved in navigating the ship. In another example, Majchrzak, More, and Faraj (2011) explored the practices by which three cross-functional teams coordinated knowledge—and simultaneously avoided deep understandings of each other's area of specialty. Each team sought to develop just enough common ground to facilitate action, but did not engage in the deep dialogue that much of the literature (e.g. Bechky, 2003; Carlile, 2004; Kellogg, Orlikowski, & Yates, 2006) has emphasized as important to developing common ground. In fact, avoiding deep dialogue helped teams side-step potential conflicts that would have emerged had they sought to achieve common knowledge. Further, Bechky's (2006) study of role-based coordination in film production teams demonstrates a similar mechanism by which knowledge can be coordinated without actively engaging in integration-oriented dialogue. She found that culturally engrained understandings of the *roles* that occupational groups play in the film production process allowed for rapid assembly and execution. The three techniques—embedding knowledge in artifacts and routines, avoiding deep dialogue, and operating on broadly accepted conceptions of roles—demonstrate that managing the integration-differentiation tension is a complex accomplishment, one that often relies on shallow (rather than deep) knowledge of both the task and of others' roles. At the same time, however, these studies demonstrate that maintaining differentiation is *not* a passive process: Routines need to be established and learned, groups need to develop norms of trust that allow for minimal sharing, and occupations need to develop the role-based knowledge necessary to afford this type of engagement. If KM scholarship were to pursue a deeper understanding of this type of balance, we see at least two areas worthy of increased scholarly attention: producing

a deeper understanding of the skills involved in determining which knowledge to share, and understanding the potential unintended consequences associated with integrating knowledge.

An important direction for KM scholarship in grappling with the tension between integration and differentiation is to examine how organizational units evaluate which knowledge *needs* to be shared in a context. If there is value to being judicious about which knowledge is worth sharing, then *evaluation* will be central realizing this value. Along these lines, sociologists of expertise such as Harry Collins (Collins, 2013; Collins & Evans, 2002, 2007; Collins, Evans, & Gorman, 2007), have written about the growing importance of what they call *interactional expertise* in contemporary organizational contexts. Interactional expertise is a mastery of the language of a particular domain absent the capacity to contribute to that domain's practice; it plays an important role in facilitating the coordination and translation of knowledge across boundaries (Collins & Evans, 2007).

Individuals with interactional expertise in another individual's or group's domain of practice have a greater capacity to translate coded activities across existing boundaries, aid in the resolution of conflicts, and facilitate actors' senses of mutual accountability to the practice. Importantly, because this expertise is based around discussion of practice, and not the material and embodied abilities defining practice, it may be easier and less costly to acquire, and accessible to a wider group of workers (Collins et al., 2007). The recent attention to the importance of in-house *organizational anthropologists* (or ethnographers) resonates with this move (Tian & Walle, 2009). Although some organizational anthropologists are charged with understanding customer beliefs and behaviors, the role is more frequently about understanding organizational practice and generating insights for use in strategic decision-making (Jordan, 2010); some even argue that strategic managers should inhabit this role to develop a sensitivity

to the cultures and practices characterizing their organizations (Ruben, DeNisi, & Gigliotti, 2017). Provided proper authority, organizational anthropologists can also foment dissent and interrogation of assumptions alongside efforts to create shared knowledge, based on the idea that it is only from *within* practice that judgments about whether (and how) to emphasize either integration or differentiation can be fruitful.

When individuals—whether or not they are organizational anthropologists—possess interactional expertise, they are capable of framing their communication with cross-boundary peers in a manner that fosters exchange without producing overlap. More importantly, interactional expertise can play an important role in allowing individuals to gauge precisely how much knowledge needs to be shared in a specific moment (Barley, 2015; Nonaka & Toyama, 2007; Shotter & Tsoukas, 2014; Treem & Barley, 2016). In MOS research, concepts such as cross-understanding (Huber & Lewis, 2010), directory development (Brandon & Hollingshead, 2004; Yuan, Fulk, Monge, & Contractor, 2010), and meta-expertise (Faraj & Sproull, 2000) describe similar characteristics, and point to the increasing importance that this type of understanding of an organization's sub-units plays in affording the judicious balance between integration and differentiation.

Practically understanding these tensions in action will require a shift in the types of research questions that KM scholars ask as they approach research contexts. Rather than seeking to understand the mechanisms by which organizational units share their knowledge, investigators might instead ask: *How do interactional experts determine what not to share in a particular opportunity for engagement? And, moving beyond individuals' capacities, how can organizations support, reify, and codify these processes?* However, in keeping with our framing of KM as a complex and precarious accomplishment, it is important to acknowledge interactional

expertise as a radically contextual and relational construct, which implies that developing it at one cross-unit boundary does not necessarily imply an ability to interact judiciously across all others (Collins & Evans, 2007). Given this limited transferability, it will also be important to gain insight into *the contexts under which the marginal returns on performance associated with developing interactional expertise are greater than the costs associated with developing it.*

Investigating Practices of Differentiated Knowing

Our analysis of the KM literature revealed not simply a bias toward integration, but also an assumption about the character of that which is being managed. The standard view in the KM literature understands knowledge to be "an identifiable entity, a commodity stored (i.e., located) *in* brains or bodies" (Kuhn, 2014, p. 482. Emphasis in original). Such a vision of knowledge, argue Suddaby and Greenwood (2001), is by no means natural; instead, it is the result of the deployment of particular assumptions and sustained intellectual effort. The depiction of knowledge they call *commodification* occurs when knowledge "is abstracted from context and reduced to a transparent and generic format that can be more easily leveraged" (p. 934). As discussed in our section exploring explanations for the integration bias above, when the principal aim of KM is to produce either common ground or specialization (as in Table 1) in the service of (a) accumulating, extracting, transferring, sharing, and protecting knowledge; (b) embedding knowledge in routines; or (c) capitalizing on knowledge via exploitation, then conceiving of it as a commodity, an *object*, appears logical.

This epistemological grounding framing knowledge as an object, however, has served as a point of contention since the advent of KM as a scholarly concern. Critics have drawn on a long line of social theory to denounce this cognitivism inherent in the object orientation at both the individual and collective level. Scholars have argued that the knowledge we see as possessed

by an actor is usually less stable, transferrable, and replicable than assumed (cf. Winter & Szulanski, 2001). Detailed understandings of the *doing* of work expose how knowledge is not simply a detached input into, or inhabitant of, organizational routines; it is an outcome of struggles over meaning and histories of activity. Knowledge should therefore be understood not as an object, but as an always-precarious product shaped by the languages in use—one that must be continually re-accomplished in situated activity (Antonacopoulou, 2008; Brown & Duguid, 2001; Cook & Brown, 1999; Lave & Wenger, 1991; Orlikowski, 2002, 2006; Spender, 1994). This alternative *practice-based perspective* asserts that affixing knowledge (as an object) to individuals or groups obscures what it means *to know*. In practice-based thinking, "knowing" is a reference to competent participation in action occurring in organizational scenes populated by heterogeneous arrays of discursive and material elements (Kuhn & Porter, 2011; Østerlund & Carlile, 2005). Knowledge, in turn, cannot be isolated or transferred, because identities, sites, histories, artifacts, ideas, technologies, bodies, discourses, and the like are all intimately bound together in organizing practice. Yet knowledge, as conventionally understood, is not erased in this perspective; instead, it becomes "*a tool at the service of knowing*, not something that, once possessed, is all that is needed to enable action or practice" (Cook & Brown, 1999, p. 388. Emphasis in original). The practice and the product are thus intertwined. Practice-based perspectives, then, tend to be concerned that conventional accounts of KM amount to little more than "add knowledge and stir" thinking: Emphasizing knowledge as a commodity, as an object, leads scholars to believe in the importance of sharing and locating it, but neglects an understanding of how benefits are achieved and how power operates subtly in these processes (Contu & Willmott, 2003; Marabelli & Newell, 2014).

A practice-based perspective on knowing, as an alternative to the dominant object-based conception of knowledge, makes several claims on the KM literature. These claims hinge on a shift toward the centrality of *how* questions in KM, as contrasted with *which, what,* and *where* questions. As demonstrated above, the overriding concerns in KM (at least in the extant literature) are with identifying which knowledge is to be shared, which variables are associated with organizational performance, what forms integration and differentiation should take, and where valuable knowledge is located. The practice-based view, in contrast, directs attention to how myriad elements are configured to produce knowledgeable action, how learning is evident in altered practices, how expertise emerges (and how it is made to matter), and how contradictions in a practice (or a constellation of practices) are managed. *How* questions, in other words, lead analyses in directions that differ from conventional KM literature. Yet the question confronting this practice-based vision is not whether it asks different questions, but is whether it can produce novel conceptual insights and guidance for practice that matter to KM scholars, especially those working from a strategic management frame. In the remainder of this section, we sketch two specific guides for KM research based on a practice perspective, with an eye toward developing relevant novelty.

"Invisible" knowledge work. A first research direction suggested by a practice-based perspective is the illumination of previously hidden labor in the conduct of knowledge work. Interpretive studies of organizations have shown that, when we conceptually reduce organizing to interactions between a select set of variables, our analytical gaze necessarily obscures a good deal of work without which routine action could not proceed. Though not always conducted under the aegis of KM research, practice-based studies display how invisible, or hidden, work makes possible the work that is observed. Invisible work includes the subtle moves that evince

unstated rules (Llewellyn & Hindmarsh, 2013; Suchman, 2000), private and unpaid (and thus often gendered) labor (Daniels, 2014; Smith, 2001), "articulation work" that adjusts and monitors activity to get activity "back on track" after unexpected events (Strauss, Fagerhaugh, Suczek, & Wiener, 1985), "process" work that is not easily aligned with the work of professions (Treem & Barley, 2016) and work which is in some sense distant from the focal activity (Leonardi, Huysman, & Steinfeld, 2013). A practice perspective encourages attention to this invisible labor, including the work performed by nonhuman participants such as KM systems. One route to pursue invisible labor in KM would be to examine efforts to shape the metrics and indicators by which work is evaluated. As critical accounting scholars have noted, control over these metrics and indicators is key to defining what counts as work in the first place and are sites in which struggles over meaning can be observed (Power, 2001). Particularly in the case of knowledge work, which is less directly observable and assessable than other forms of labor, shaping the means of recognizing when work occurs is directly relevant not merely to guiding the work of innovation, but also to monitoring, controlling, and rewarding (or punishing) workers (Star & Strauss, 1999). Thus, potential research questions for this sort of direction would ask (a) *how the invisible interactive work conducted by human and nonhuman participants develops and promulgates assessments (i.e., metrics and indicators) of knowledge and knowledge work*; (b) *how, through those interactions, particular interests become inscribed into those assessments*; and (c) *whether particular forms of practice are associated with an emphasis on either common ground or specialization*.

Heterogeneity in knowledge and knowing. A second practice-based research direction for KM scholarship is to examine the importance of differentiation, via the exposure to difference, in organizational practice. For instance, Bruns's (2013) aforementioned study of a

dispersed systems biology research program showed collaboration and coordination to be highly complex and contextualized processes. They occurred both within and across domains only when situated practices—both individual and collective—were in place. In contrast to the assertion in much of the KM literature that *integrated* knowledge is required to generate the collaboration and coordination associated with organizational innovation, Bruns' study suggests that exposure to work in other areas, as a display of *differentiation*, can be an important contributor to coordination. She calls, then, for tactics that can aid actors in appreciating differences, including shadowing, job rotation, workshops, and training in communicative practices that foster cross-domain dialogue; these tactics retain each domain's unique knowledge and foster an understanding of the differences that enable a division of labor to operate successfully. Foregrounding forms of communicative practice in the pursuit of coordination and collaboration can aid in overcoming the conception of knowledge as a commodity that can travel easily from place to place and, once received in the desired location, will produce frictionless action. Practice-based thinking highlights the ever-present potential for schisms and breakdowns, along with the array of sub-practices required to accomplish the processes often taken for granted in the KM literature. Research in this vein would investigate how heterogeneity in knowledge and knowing—in the sense of both multiple individuals and multiple trajectories of practice in a single site (Schatzki, 1996)—has the potential to generate not merely conflict and ambiguity (as a conventional conception of KM might suggest), but also new conceptual frames for the practice in question (Kuhn & Porter, 2011). A research aim pursuing the generativity of tensions and paradoxes resulting from the heterogeneity of knowledge and knowing must be accompanied by an understanding that reframing is not always instrumentally beneficial or managerially desirable. Indeed, reframing often is mediated by, and the outcome of, significant intra-

organizational conflicts (Dewulf et al., 2009; Fairhurst, 2007; Kuhn & Corman, 2003); it may lead to outcomes unaligned with strategic aims; and may just as easily close off as open up efforts to innovate. In short, heterogeneity and reframing must be *managed*, but efforts to produce order out of heterogeneity are likely to carry unintended consequences (Vásquez, Schoeneborn, & Sergi, 2016).

Beyond this, a related line of thinking acknowledges that, for organizations operating in complex and turbulent environments, organizational *ambidexterity* may be beneficial. Scholarship considering the differential absorptive capacity of organizations and groups recognizes the importance of a firm's ability to integrate, assimilate, and act upon internal and external sources of knowledge (Lane et al., 2001; Marabelli & Newell, 2014; Volberda et al., 2010). In this light, ambidexterity refers to the capacity to absorb knowledge through a balance of exploration and exploitation, enabling business units to both enact adaptability and alignment with organizational goals (Gibson & Birkinshaw, 2004; Raisch, Birkinshaw, Probst, & Tushman, 2009). Although work on ambidexterity has been tremendously helpful for insights into how organizations pursue multiple goals, either in cyclical or simultaneous fashion, it provides less insight on cases in which stakeholders, both internal and external, may use conflicting evaluative criteria—which are common elements of the contemporary organizational landscape (Hsu & Hannan, 2005)—in evaluating organizational action. What complex organizations require in such conditions, suggests Stark (2009), are practices that foster a capacity to speak to multiple evaluative principles simultaneously: The organizational imperative is to "*keep multiple evaluative principles in play and to exploit the resulting friction of their interplay*" (p. 15, emphasis in original). From this perspective, KM initiatives that emphasize integration (i.e., common ground) run the risk of being able to appeal to only a limited range of evaluative

principles; this restriction, in turn, works at cross-purposes with their desire to manage exogenous and endogenous uncertainty. The notion of exploiting the friction of evaluative principles' interplay suggests, instead, a need for organizational practices that can (a) display the value of organizational action for manifold stakeholder groups (Gehman et al., 2013), and (b) reframe conventional practices to embrace alternative modes of knowing as a route to recognizing possibilities for innovation (Nicholls, 2009). Research on this theme might, then, inquire about *how knowledge heterogeneity produces practices that reframe and/or challenge existing KM initiatives, with an eye toward how efforts to engage heterogeneity foster or inhibit the innovative management of integration-differentiation tensions.*

Knowledge Management as a Form of Ongoing Organizational Change

A strength of seeing KM through a practice lens is the recognition of the dynamic character of knowledge. One reason why the integration bias described earlier limits our understanding of organizational knowledge and KM is that it risks presenting knowledge as a static commodity, a resource useful at a particular time. Even in situations where the espoused goal is knowledge creation and integration, the benefits of producing common ground are motivated by the idea is that knowledge, once made manifest, is of a distinct form that is useful for the organization. As a result, knowledge trajectories in organizations have largely been presented as unidimensional (treating knowledge in a singular form) and unidirectional (knowledge moves in a particular direction). This approach is attractive because it lends itself to variance approaches (Poole & Van de Ven, 1989) that treat knowledge as a stable and predictable input to, or output of, an organizational system. KM initiatives can then be conceptualized as failures or successes based on clear assessment criteria (Schultze & Leidner, 2002). However, variance approaches to KM presents two limitations: (a) they discount the

dynamic nature of knowledge and the myriad ways that knowledge is managed over time, as presented in the preceding subsections; and (b) they obscure the possibility of differential knowledge trajectories, and differential outcomes, at different levels of analysis.

Yet to say that knowledge is a dynamic construct will not offer analytic utility unless we take efforts to understand *how* changes in knowledge take place in organizational contexts over time. Applying concepts of organizational change, while viewing KM activities themselves as the objects of analysis may offer a vantage point to pursue understanding of such dynamism (Van de Ven & Poole, 1995). Commonly, KM research offers individuals, groups, or some operationalized representation of knowledge as the unit of analysis, applying survey methods that utilize cross-sectional data to determine relationships between the level (or type) of knowledge and some feature of collective performance (Cummings, 2004; Gold, Malhotra, & Segars, 2001; Lee & Choi, 2003; Levin & Cross, 2004; Szulanski, 2000). This approach perpetuates an integration bias in part because it requires the researcher to declare the knowledge trajectory of interest prior to analysis (e.g., differentiation to integration), a conceit that often favors the study of integrative processes. Alternatively, studying KM initiatives and related activities across time and across levels of analysis does not require an a priori assumption regarding any particular knowledge trajectory and allows the possibility of multiple knowledge trajectories. Recognizing the inherently dynamism of knowledge in organizations, scholars have acknowledged that even organizational routines, which are viewed as a means of institutionalizing organizational knowledge and facilitating predictable actions, are sources of continuous change (Feldman & Pentland, 2003). As a result, an organization's capabilities to manage knowledge, as well as its KM needs, will shift based on both structural and interactional alterations in the organization over time (Argote, McEvily, & Reagans, 2003).

A change-oriented perspective on KM is consistent with a perspective that views organizations as constituted by systems of knowledge (Holzner & Marx, 1979). As Pentland (1995, p. 5) noted regarding processes of knowledge, "The idea is that knowledge is the product of an ongoing set of practices embedded in the social and physical structures of the organization. It is meant to convey the dynamic quality of the overall system." A systems approach recognizes KM as the ongoing interplay of actors, artifacts, and activity that creates an interdependent network of relations (Blackler, 1995; Garud & Kumaraswamy, 2005; Holzner & Marx, 1979; Pentland, 1995; Spender, 1996). This perspective is attractive because it recognizes the dynamic ways knowledge is utilized, recognizes a role for artifacts and non-human actors in processes of knowledge, and looks at KM as occurring both within specific relations (components of the system) and a larger organizational network. In discussing ways to study processes of change in organizations Langley, Smallman, Tsoukas, and Van de Ven (2013) note the importance of considering two elements in an analysis: Time and changes in activity. Integrating time and temporality into the study of KM will inform how changes in the organizational environment influence KM processes, help examine KM initiatives from development through implementation and use, and consider changes in the nature of KM technologies over time. Additionally, looking at KM systems as networks of action and activity will help reveal KM processes at multiple levels of organizations, incorporate non-human actors into the study or KM, and recognize how the visible articulation of network relations can alter KM processes.

Temporality. Change takes place over time, and examining KM as a longitudinal process will help capture the form and frequency of alterations in knowledge trajectories. Recognizing the mechanisms of change present in KM, scholars have represented KM in organizations in terms of stages (Szulanski, 2000) or cycles (Birkinshaw & Sheehan, 2002; Garud &

Kumaraswamy, 2005). These approaches recognize that the organizational uses for knowledge in an organization may shift and that knowledge processes may develop an inertia, or path dependency, that affects their predictability and susceptibility to change. Further, organizations may, over time, develop resources or build on experiences in ways that influence KM outcomes (Gold et al., 2001). Acknowledging this dynamism offers an analytical space in which trajectories of integration or differentiation may emerge.

Attewell (1992) demonstrated the benefit of a process approach to the study of organizational learning in his description of how business computing knowledge diffused through organizations over decades. Early on, when business computing was both novel and resource intensive, it was strategically advantageous to outsource computing tasks to specialist service organizations. Over time, firms garnered computer gurus and developed departments with specialized knowledge in business computing. As knowledge of business computing became more common, these specialist departments became marginalized and started to dissolve amidst growing expectations that workers possess a knowledge base adequate for self-service. Analyzing changes in how organizations managed knowledge over decades revealed a shift from actively sustaining differentiated knowledge to working to integrate knowledge; doing so also displayed how changes in trajectories were intertwined with shifts in available resources, including knowledge gained over time.

Another benefit of implementing temporality into the study of KM and organizational change is that it can foreground the role and intentions of management in KM processes. Though KM is a concept frequently invoked in the study of organizational knowledge, there is a disproportionate focus on knowledge outcomes, and little explicit recognition of actions taken by organizations to manage that knowledge (Alvesson & Kärreman, 2001). A change-oriented

perspective means that KM can be analyzed both in relation to distinct purposeful decisions of organizational authorities and in terms of ongoing emergent influences that alter organizational knowledge. Taking time into consideration encourages analysts to cross the "implementation line" (Leonardi, 2009) and ask questions related to how the development of KM initiatives may contribute to subsequent organizational changes. For example, Garud and Kumaraswamy (2005) traced KM initiatives at a software services company where management sought to capture and codify the experiences of workers, eventually leading to the development of a central KM portal that housed workers' contributions. Seeking to populate the portal, management created an incentive for contributions to the KM system, which resulted in a spike in contributions, but a low quality of knowledge provided. Subsequently, individuals searching for information became deterred by the need to sort through the wealth of the material in the KM system and decreased their use of it, creating a "vicious cycle" of (dis)use. It was only in understanding the decisions of management in implementing the incentive and in investigating the unfolding of the initiative over time that this study was able to ascertain this unintended (and interesting) consequence.

Garud and Kumaraswamy's study also highlights the role that time can play in altering local meanings for, and uses of, KM technologies. In KM initiatives, technologies like portals can be viewed as public goods in that they offer a resource available to all, but one to which not all individuals are obligated to contribute (Fulk, Flanagin, Kalman, Monge, & Ryan, 1996). As such, KM technologies are perpetually at risk of failure due to lack of contributions, maintenance, and use. KM scholarship has examined the dilemma of eliciting individual contributions to communal knowledge repositories, and find that even when KM initiatives overcome obstacles to initial contributions, they face problems associated with crowdedness and perceived value as they extend in time (Kankanhalli et al., 2005; Ma & Agarwal, 2007; Wasko &

Faraj, 2005). As contributions to repositories build, in can be increasingly difficult to find specific information (Merritt, Ackerman, & Hung, 2016). More broadly, the meanings (and sets of possibilities) of the KM system change over time as it is used by organizational members. Only by viewing KM initiatives longitudinally can we see the ways in which the system evolves in terms of use and usefulness, and identify when technologies designed for integrating knowledge may be understood as (in)capable of meeting that goal--or if they elicit alternative actions that support differentiated knowledge. Particularly when KM initiatives and technologies are used across multiple organizational units and levels, differing interpretations and uses can create challenges to coordination; if managerial expectations revolve around integrated knowledge and seamless coordination across those units or levels, shifts in use over time can create operational challenges. Developing a better understanding the intentions of management in designing and implementing KM systems, along with the sociomaterial ways these systems change over time (irrespective of managerial intent), can provide a richer understanding of organizational appropriations of KM systems. This line of inquiry, then, would advance questions about *whether and why interpretations and uses of KM tools shift over time, and how those changes generate challenges to efforts to create knowledge integration or differentiation.*

Knowledge networks. One additional route to (re)conceptualizing KM is to start with the *knowledge network*, a vision of the distribution of knowledge across interconnected participants. The notion of a knowledge network moves away from conceptualization of organizational knowledge an aggregate stock of knowledge located in individuals and routines, and embraces the notion that collective knowledge exists in the links between knowledge elements relevant to organizing (Contractor & Monge, 2002; Hansen, 2002; Jarvenpaa & Majchrzak, 2008; Wasko & Faraj, 2005). Phelps, et al. (2012) portray these knowledge

networks as a set of nodes, "individuals or higher level collectives that serve as heterogeneously distributed repositories of knowledge and agents that search for, transmit, and create knowledge—interconnected by social relationships that enable and constrain nodes' efforts to acquire, transfer, and create knowledge" (p. 1117). Yet these nodes need not be limited to human actors and bits of information; as Contractor, Monge, and Leonardi (2011) note that knowledge networks can be both *multimodal*, meaning that there is likely to be a wide variety of participants in the network (e.g., persons, artifacts, documents, technologies, etc.), and *multiplex*, meaning that multiple types of relationships among nodes can be represented. Put differently, an object such as knowledge repository, an expert recommender system, or an online document, can be conceptualized as providing knowledge to or receiving knowledge from organizational activity.

If knowledge networks are multimodal and multiplex, they also span levels of analysis. Though conceptually attractive, tracking knowledge networks across levels of analysis is analytically challenging (Hitt, Beamish, Jackson, & Mathieu, 2007; Morgeson & Hofman, 1999). Yet investigating cross-level relationships is important because the composite of micro level processes exhibits emergent outcomes that can create group-level effects; at the same time, collective structures constrain and enable lower-level processes (Kozlowski & Klein, 2000). Within the contexts of KM, this cross-level relationship has been useful for analyzing the allocation and retrieval of knowledge among organizational experts in group contexts (Yuan et al., 2010), where individuals' decisions to share or exchange knowledge are influenced both by their individual attributes and network position, but also attributes and structures at the level of the network. Novel statistical analyses such as exponential random graph modeling (Contractor, Wasserman, & Faust, 2006) or agent-based modeling (e.g. Palazzolo, 2005) allow for simulations or the use of large-scale data sets that test multiple theoretical mechanisms

simultaneously across multiple levels of network data. Capturing multiple levels of network influences provides a fuller picture of the drivers of change in KM systems.

Additionally, framing KM in network terms directs attention to the roles meta-knowledge may play in organizational processes. Specifically, KM initiatives (and, in particular, the use of KM technologies that provide directories of relationships or expertise), can develop understandings of "who knows what" and "who knows who" in organizations (Jackson & Klobas, 2008; Nevo & Wand, 2005). This meta-knowledge can make the work and expertise of others more visible, and articulate organizational networks that were previously obscured (Cross, Borgatti, & Parker, 2002). The importance of meta-knowledge is based on a recognition that KM is based not merely on a static network of organizational knowledge, but can present a platform for active *networking* in organizations in which individuals seek to influence perceptions of knowledge held by coworkers, and to locate new sources of insight in the pursuit of innovations (DiMicco, Geyer, Millen, Dugan, & Brownholtz, 2009). Scholars have recognized that studying the consequences of this network articulation is particularly important given the increased adoption of social media technologies within organizational contexts (Kane, Alavi, Labianca, & Borgatti, 2014; Treem & Leonardi, 2012). If KM technologies are increasingly designed to make associations among individuals or content visible, it may alter the ways workers chose to communicate knowledge to others (Leonardi & Treem, 2012), or create a competitive marketplace for knowledge resources (Hansen & Haas, 2001). Analyses guided by a focus on knowledge networks might then ask *how different actors and relations engaged in KM might play distinct roles in processes of knowledge integration and differentiation, how KM processes at one level of a knowledge network might influence process at another level, and how meta-*

knowledge of a knowledge network facilitated by KM influences processes of knowledge integration and differentiation.

Conclusion

In our introduction, we observed that knowledge-based theories of the firm are closely coupled, but distinct, from the field of KM. Although KM research has largely evolved from the shift toward knowledge-based theory, we have shown that KM scholarship over the past two decades has privileged particular trajectories of knowledge over others. Although we have compelling evidence that integrational processes play an important role in measurable organizational outcomes, we believe an important step forward for KM research will involve broadening our analytic scope to include a more dynamic vantage of managing knowledge in organizational contexts. Incorporating a multitude of knowledge trajectories into the study of KM, and taking seriously the potential value of differentiation, offers new opportunities for scholarship to explore the ways that KM can provide organizational value.

As a final comment, we would like to reflect on the nature of knowledge in today's organizational contexts as it relates to the context of organizing when the field of KM evolved in the 1990s. As we have evolved firmly into an information and knowledge economy, the primary problems of knowledge and organizing may be in the midst of important shifts. A growing number of social and technical changes have afforded organizations an increasing capacity for access to information, knowledge resources, and domain experts such that *knowledge access* may no longer be the central problems that organizations face. The presence of massive data repositories, records of consumer behavior, and the ability to establish and maintain ties with individuals through online social networks means that workers have greater abilities to access knowledge resources or interact with knowledgeable others. Finding opportunities to aggregate or access knowledge is much less the problem than is managing the fire-hose. The problems in a

context of high knowledge access are meaningfully different: the important questions shift from gathering as much knowledge as possible to figuring out when to *stop* gathering information. They shift from getting everything you can to *evaluating which* knowledge is *worthy* of inclusion. At its heart, the current era seems to involve increased cachet for knowledge trajectories beyond integrational processes. However, limiting opportunities for information access and knowledge development may be difficult; once the fire hose is turned on it may be hard to convince people not to keep drinking. Individuals may continue to seek available knowledge beyond the point it is beneficial for decision making for symbolic reasons, so that others in the organization will view them as acting in a responsible manner (Feldman & March, 1981). Though advances in technologies and investments in KM appear to favor opportunities for integrative trajectories, it remains to be seen how organizations might effectively develop technological, structural, or relational strategies to help restrict or filter knowledge access in some manner.

This trend exemplifies the point that knowledge differentiation should be recognized as much more than the mere presence of unintegrated knowledge. Rather knowledge differentiation is a trajectory of knowledge to which organizations should consider focusing KM strategy and associated practices. Just as knowledge integration involves active work to overcome the obstacles associated with the presence of diverse sets of knowledge in organizations, so too does knowledge differentiation require purposeful effort and structural support to provide space to establish and maintain specialized work. Greater focus on knowledge differentiation broadens the potential value associated with KM in organizations, embraces calls for dynamism in the study of organizational knowledge, and promotes a research agenda for KM that captures the breadth of knowledge trajectories present in contemporary work.

Work Cited

Ackerman, M., Dachtera, J., Pipek, V., & Wulf, V. (2013). Sharing knowledge and expertise: The cscw view of knowledge management. *Computer Supported Cooperative Work (CSCW), 22*(4-6), 531-573. doi:10.1007/s10606-013-9192-8

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *Mis Quarterly, 25*(1), 107-136.

Aldrich, H. (1971). Organizational boundaries and inter-organizational conflict. *Human Relations, 24*(4), 249-293. doi:10.1177/001872677102400401

Alvesson, M., & Kärreman, D. (2001). Odd couple: Making sense of the curious concept of knowledge management. *Journal of Management Studies, 38*(7), 995-1018. doi:10.1111/1467-6486.00269

Amin, A., & Roberts, J. (2008). Knowing in action: Beyond communities of practice. *Research Policy, 37*(2), 353-369. doi:10.1016/j.respol.2007.11.003

Anand, V., Manz, C. C., & Glick, W. H. (1998). An organizational memory approach to information management. *Academy of Management Review, 23*(4), 796-809.

Antonacopoulou, E. P. (2008). On the practise of practice: In-tensions and ex-tensions in the ongoing reconfiguration of practices *The sage handbook of new approaches in management and organization* (pp. 112-131). Los Angeles: SAGE.

Argote, L. (2012). *Organizational learning: Creating, retaining and transferring knowledge*: Springer Science & Business Media.

Argote, L., & Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes, 82*(1), 150-169. doi:10.1006/obhd.2000.2893

Argote, L., McEvily, B., & Reagans, R. (2003). Managing knowledge in organizations: An integrative framework and review of emerging themes. *Management Science, 49*(4), 571-582.

Argote, L., & Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organization Science, 22*(5), 1123-1137. doi:10.1287/orsc.1100.0621

Attewell, P. (1992). Technology diffusion and organizational learning: The case of business computing. *Organization Science, 3*(1), 1-19.

Austin, J. R. (2003). Transactive memory in organizational groups: The effects of content, consensus, specialization, and accuracy on group performance. *Journal of Applied Psychology, 88*(5), 866-878.

Barley, W. C. (2015). Anticipatory work: How the need to represent knowledge across boundaries shapes work practices within them. *Organization Science*. doi:10.1287/orsc.2015.1012

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120. doi:10.1177/014920639101700108

Bechky, B. (2003). Sharing meaning across occupational communities: The transformation of understanding on the production floor. *Organization Science, 14*(3), 312-330. doi:10.1287/orsc.14.3.312.15162

Bechky, B. (2006). Gaffers, gofers, and grips: Role-based coordination in temporary organizations. *Organization Science, 17*(1), 3-21.

Bechtoldt, M. N., De Dreu, C. K. W., Nijstad, B. A., & Choi, H. (2010). Motivated information processing, social tuning, and group creativity. *Journal of Personality and Social Psychology, 99*(4), 622.

Bell, D. (1973). *The coming of post-industrial society*. New York: Basic Books.

Birkinshaw, J., & Sheehan, T. (2002). Managing the knowledge life cycle. *MIT Sloan Management Review, 44*(1), 75.

Blackler, F. (1995). Knowledge, knowledge work and organizations: An overview and interpretation. *Organization Science, 16*(6), 1021-1046. doi:10.1177/017084069501600605

Bock, G., Zmud, R. W., Kim, Y., & Lee, J. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *Mis Quarterly, 29*(1), 87-111.

Bontis, N. (1999). Managing organizational knowledge by diagnosing intellectual capital: Framing and advancing the state of the field. *International Journal of Technology Management, 18*(5-8), 433-462. doi:10.1504/ijtm.1999.002780

Bowker, G. C. (1997). Lest we remember: Organizational forgetting and the production of knowledge. *Accounting, Management and Information Technologies, 7*(3), 113-138. doi:10.1016/S0959-8022(97)90001-1

Brandon, D. P., & Hollingshead, A. B. (2004). Transactive memory systems in organizations: Matching tasks, expertise, and people. *Organization Science, 15*(6), 633-644. doi:10.1287/orsc.1040.0069

Breschi, S., & Lissoni, F. (2009). Mobility of skilled workers and co-invention networks: An anatomy of localized knowledge flows. *Journal of Economic Geography, 9*(4), 439-468. doi:10.1093/jeg/lbp008

Brodbeck, F. C., Kerschreiter, R., Mojzisch, A., Frey, D., & Schulz-Hardt, S. (2002). The dissemination of critical, unshared information in decision-making groups: The effects of pre-discussion dissent. *European Journal of Social Psychology, 32*(1), 35-56. doi:10.1002/ejsp.74

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science, 2*(1), 40-57. doi:10.1287/orsc.2.1.40

Brown, J. S., & Duguid, P. (2001). Knowledge and organization: A social-practice perspective. *Organization Science, 12*(2), 198-213. doi:10.1287/orsc.12.2.198.10116

Bruni, A., Gherardi, S., & Parolin, L. L. (2007). Knowing in a system of fragmented knowledge. *Mind, Culture, and Activity, 14*(1-2), 83-102.

Bruns, H. C. (2013). Working alone together: Coordination in collaboration across domains of expertise. *Academy of Management Journal, 56*(1), 62-83. doi:10.5465/amj.2010.0756

Brusoni, S., Prencipe, A., & Pavitt, K. (2001). Knowledge specialization, organizational coupling, and the boundaries of the firm: Why do firms know more than they make? *Administrative Science Quarterly, 46*(4), 597-621. doi:10.2307/3094825

Burt, R. S. (2004). Structural holes and good ideas. *American Journal of Sociology, 110*(2), 349-399. doi:doi:10.1086/421787

Carlile, P. R. (2002). A pragmatic view of knowledge and boundaries: Boundary objects in new product development. *Organization Science, 13*(4), 442-455. doi:10.1287/orsc.13.4.442.2953

Carlile, P. R. (2004). Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization Science, 15*(5), 555-568. doi:10.1287/orsc.1040.0094

Castells, M. (2000). *The information age: Economy, society and culture. Vol. 1, the rise of the network society* (Vol. 1). Oxford: Blackwell.

Chang, H. H., & Chuang, S. (2011). Social capital and individual motivations on knowledge sharing: Participant involvement as a moderator. *Information & Management, 48*(1), 9-18. doi:10.1016/j.im.2010.11.001

Cohen, M. D., March, J. G., & Olsen, J. P. (1976). People, problems, solutions and the ambiguity of relevance *Ambiguity and choice in organizations* (pp. 25-37). Bergen, Norway: Universitetsforlaget

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128-152.

Collins, H. M. (1993). The structure of knowledge. *Social research, 60*(1), 95-116.

Collins, H. M. (2013). Three dimensions of expertise. *Phenomenology and the Cognitive Sciences, 12*(2), 253-273. doi:10.1007/s11097-011-9203-5

Collins, H. M., & Evans, R. (2002). The third wave of science studies: Studies of expertise and experience. *Social Studies of Science, 32*(2), 235-296. doi:10.1177/0306312702032002003

Collins, H. M., & Evans, R. (2007). *Rethinking expertise*. Chicago, IL: University of Chicago Press.

Collins, H. M., Evans, R., & Gorman, M. (2007). Trading zones and interactional expertise. *Studies in History and Philosophy of Science, 38*(4), 657-666. doi:10.1016/j.shpsa.2007.09.003

Contractor, N., & Monge, P. (2002). Managing knowledge networks. *Management Communication Quarterly, 16*, 249-258.

Contractor, N., Monge, P. R., & Leonardi, P. M. (2011). Multidimensional networks and the dynamics of sociomateriality: Bringing technology inside the network. *International Journal of Communication, 5*, 682-720.

Contractor, N., Wasserman, S., & Faust, K. (2006). Testing multitheoretical, multilevel hypotheses about organizational networks: An analytic framework and empirical example. *Academy of Management Review, 31*(3), 681-703. doi:10.5465/AMR.2006.21318925

Contu, A., & Willmott, H. (2003). Re-embedding situatedness: The importance of power relations in learning theory. *Organization Science, 14*(3), 283-296. doi:10.1287/orsc.14.3.283.15167

Cook, S. D. N., & Brown, J. S. (1999). Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing. *Organization Science, 10*(4), 381-400. doi:10.1287/orsc.10.4.381

Cramton, C. D. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science, 12*(3), 346-370. doi:10.1287/orsc.12.3.346.10098

Cross, R., Borgatti, S. P., & Parker, A. (2002). Making invisible work visible: Using social network analysis to support strategic collaboration. *California Management Review, 44*(2), 25.

Crossan, M. M., Lane, H. W., & White, R. E. (1999). An organizational learning framework: From intuition to institution. *Academy of Management Review, 24*(3), 522-537.

Cummings, J. N. (2004). Work groups, structural diversity, and knowledge sharing in a global organization. *Management Science, 50*(3), 352-364.

Cyert, R. M., & March, J. G. (1963). A summary of basic concepts in the behavioral theory of the firm *A behavioral theory of the firm* (pp. 161-176). Cambridge, MA: Blackwell Publishing.

Cyert, R. M., & March, J. G. (1992). *A behavioral theory of the firm* (2nd ed.). Malden, MA: Blackwell Business.

Daniels, A. K. (2014). Invisible work. *Social Problems, 34*(5), 403-415. doi:10.2307/800538

Davenport, T. H., De Long, D. W., & Beers, M. C. (1998). Successful knowledge management projects. *Sloan Management Review, 39*(2), 43-57.

Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston, MA: Harvard Business School Press.

de Holan, P. M., & Phillips, N. (2004a). Organizational forgetting as strategy. *Strategic Organization, 2*(4), 423-433. doi:10.1177/1476127004047620

de Holan, P. M., & Phillips, N. (2004b). Remembrance of things past? The dynamics of organizational forgetting. *Management Science, 50*(11), 1603-1613.

De Long, D. W., & Fahey, L. (2000). Diagnosing cultural barriers to knowledge management. *Academy of Management Executive, 14*(4), 113-127.

Demarest, M. (1997). Understanding knowledge management. *Long Range Planning, 30*(3), 374-384. doi:10.1016/s0024-6301(97)90250-8

Dewulf, A., Gray, B., Putnam, L., Lewicki, R., Aarts, N., Bouwen, R., & van Woerkum, C. (2009). Disentangling approaches to framing in conflict and negotiation research: A meta-paradigmatic perspective. *Human Relations, 62*(2), 155-193. doi:10.1177/0018726708100356

DiMicco, J., Geyer, W., Millen, D. R., Dugan, C., & Brownholtz, B. (2009). *People sensemaking and relationship building on an enterprise social networking site.* Paper presented at the 42nd Annual Hawaii International Conference on System Sciences

Dougherty, D. (1992). Interpretive barriers to successful product innovation in large firms. *Organization Science, 3*(2), 179-202. doi:10.1287/orsc.3.2.179

Drucker, P. F. (1994). *Post-capitalist society*: Routledge.

Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The toyota case. *Strategic Management Journal, 21*(3), 345-367. doi:10.1002/(sici)1097-0266(200003)21:3<345::aid-smj96>3.3.co;2-e

Empson, L. (2001). Fear of exploitation and fear of contamination: Impediments to knowledge transfer in mergers between professional service firms. *Human Relations, 54*(7), 839-862. doi:10.1177/0018726701547003

Fairhurst, G. T. (2007). *Discursive leadership: In conversation with leadership psychology*. Los Angeles: SAGE.

Faraj, S., & Sproull, L. (2000). Coordinating expertise in software development teams. *Management Science, 46*(12), 1554-1568.

Faraj, S., & Xiao, Y. (2006). Coordination in fast-response organizations. *Management Science, 52*(8), 1155-1169. doi:10.1287/mnsc.1060.0526

Feldman, M. S., & March, J. G. (1981). Information in organizations as signal and symbol. *Administrative Science Quarterly, 26*(2), 171-186. doi:10.2307/2392467

Feldman, M. S., & Pentland, B. T. (2003). Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly, 48*(1), 94-118.

Fleming, L., Mingo, S., & Chen, D. (2007). Collaborative brokerage, generative creativity, and creative success. *Administrative Science Quarterly, 52*(3), 443-475. doi:10.2189/asqu.52.3.443

Fleming, L., & Singh, J. (2010). Lone inventors as sources of breakthroughs: Myth or reality? *Management Science, 56*(1), 41-56. doi:10.1287/mnsc.1090.1072

Friedman, J. (1990). Being in the world: Globalization and localization. *Theory, Culture & Society, 7*(2), 311-328. doi:10.1177/026327690007002018

Fulk, J., Flanagin, A. J., Kalman, M. E., Monge, P. R., & Ryan, T. (1996). Connective and communal public goods in interactive communication systems. *Communication Theory, 6*(1), 60-87. doi:10.1111/j.1468-2885.1996.tb00120.x

Galbraith, J. (1973). *Designing complex organizations*. Reading, MA: Addison-Wesley.

Garud, R., & Kumaraswamy, A. (2005). Vicious and virtuous circles in the management of knowledge: The case of infosys technologies. *Mis Quarterly*, 9-33.

Gavetti, G., Levinthal, D., & Ocasio, W. (2007). Neo-carnegie: The carnegie school's past, present, and reconstructing for the future. *Organization Science, 18*(3), 523-536.

Gertler, M. S. (2003). Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there). *Journal of Economic Geography, 3*(1), 75-99. doi:10.1093/jeg/3.1.75

Gherardi, S., & Nicolini, D. (2000). To transfer is to transform: The circulation of safety knowledge. *Organization, 7*(2), 329-348. doi:10.1177/135050840072008

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal, 47*(2), 209-226.

Gibson, C. B., & Vermeulen, F. (2003). A healty divide: Subgroups as a stimulus for team learning behavior. *Administrative Science Quarterly, 48*(2), 202-239.

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems, 18*(1), 185-214.

Gorman, M. E. (2002). Types of knowledge and their roles in technology transfer. *The Journal of Technology Transfer, 27*(3), 219-231. doi:10.1023/A:1015672119590

Grant, R. M. (1996a). Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. *Organization Science, 7*(4), 375-387. doi:10.1287/orsc.7.4.375

Grant, R. M. (1996b). Toward a knowledge-based theory of the firm. *Strategic Management Journal, 17*(S2), 109-122. doi:10.1002/smj.4250171110

Grover, V., & Davenport, T. H. (2001). General perspectives on knowledge management: Fostering a research agenda. *Journal of Management Information Systems, 18*(1), 5-21. doi:10.1080/07421222.2001.11045672

Hansen, M. T. (2002). Knowledge networks: Explaining effective knowledge sharing in multiunit companies. *Organization Science, 13*(3), 232-248. doi:DOI 10.1287/orsc.13.3.232.2771

Hansen, M. T., & Haas, M. R. (2001). Competing for attention in knowledge markets: Electronic document dissemination in a management consulting company. *Administrative Science Quarterly, 46*(1), 1-28. doi:10.2307/2667123

Hansen, M. T., Mors, M. L., & Løvås, B. (2005). Knowledge sharing in organizations: Multiple networks, multiple phases. *Academy of Management Journal, 48*(5), 776-793.

Hargadon, A. (2003). *How breakthroughs happen: The surprising truth about how companies innovate*. Boston, MA: Harvard Business School Press.

Hargadon, A., & Fanelli, A. (2002). Action and possibility: Reconciling dual perspectives of knowledge in organizations. *Organization Science, 13*(3), 290-302. doi:10.1287/orsc.13.3.290.2772

Hargadon, A., & Sutton, R. I. (1997). Technology brokering and innovation in a product development firm. *Administrative Science Quarterly, 42*(4), 716-749. doi:10.2307/2393655

Hayek, F. A. (1945). The use of knowledge in society. *American Economic Review, 35*(4), 519-530.

Hitt, M. A., Beamish, P. W., Jackson, S., & Mathieu, J. E. (2007). Building theoretical and empirical bridges across levels: Multilevel research in management. *Academy of Management Journal, 50,* 1385-1399.

Hollingshead, A. B., Brandon, D. P., Yoon, K., & Gupta, N. (2010). Communication and knowledge-sharing errors in groups: A transactive memory perspective. In H. E. Canary & R. D. McPhee (Eds.), *Communication and organizational knowledge: Contemporary issues for theory and practice*. New York: Routledge.

Holzner, B., & Marx, J. H. (1979). *Knowledge applicatoin: The knowledge system in society*. Boston: Allyn and Bacon.

Hopwood, N. (2014). Four essential dimensions of workplace learning. *Journal of Workplace Learning, 26*(6/7), 349-363. doi:10.1108/JWL-09-2013-0069

Hsu, G., & Hannan, M. T. (2005). Identities, genres, and organizational forms. *Organization Science, 16*, 474-490. doi:0.1287/orsc.l050.0151

Huber, G. P., & Lewis, K. (2010). Cross-understanding: Implications for group cognition and performance. *Academy of Management Review, 31*(1), 6-26. doi:10.5465/amr.2010.45577787

Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: MIT Press.

Huysman, M., & de Wit, D. (2004). Practices of managing knowledge sharing: Towards a second wave of knowledge management. *Knowledge and Process Management, 11*(2), 81-92.

Inkpen, A. C., & Dinur, A. (1998). Knowledge management processes and international joint ventures. *Organization Science, 9*(4), 454-468. doi:10.1287/orsc.9.4.454

Inkpen, A. C., & Tsang, E. W. L. (2005). Social capital, networks, and knowledge transfer. *Academy of Management Review, 30*(1), 146-165.

Ireland, R. D., Hitt, M. A., & Vaidyanath, D. (2002). Alliance management as a source of competitive advantage. *Journal of Management, 28*(3), 413-446. doi:10.1177/014920630202800308

Iverson, J. O., & McPhee, R. D. (2002). Knowledge management in communities of practice. *Management Communication Quarterly, 16*(2), 259-266. doi:10.1177/089331802237239

Jackson, P., & Klobas, J. (2008). Transactive memory systems in organizations: Implications for knowledge directories. *Decision Support Systems, 44*(2), 409-424. doi:10.1016/j.dss.2007.05.001

Jarvenpaa, S. L., & Majchrzak, A. (2008). Knowledge collaboration among professionals protecting national security: Role of transactive memories in ego-centered knowledge networks. *Organization Science, 19*(2), 260-276.

Kane, G. C., Alavi, M., Labianca, G., & Borgatti, S. P. (2014). What's different about social media networks? A framework and research agenda. *Mis Quarterly, 38*, 275-304.

Kankanhalli, A., Tan, B. C. Y., & Wei, K. (2005). Contributing knowledge to electronic knowledge repositories: An empirical investigation. *Mis Quarterly, 29*(1), 113-143.

Kellogg, K. C., Orlikowski, W., & Yates, J. (2006). Life in the trading zone: Structuring coordination across boundaries in postbureaucratic organizations. *Organization Science, 17*(1), 22. doi:10.1287/orsc.1050.0157

Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science, 3*(3), 383-397.

Kogut, B., & Zander, U. (1996). What firms do? Coordination, identity, and learning. *Organization Science, 7*(5), 502-518. doi:10.1287/orsc.7.5.502

Kozlowski, S., & Klein, K. J. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal and emergent processes. In K. J. Klein & S. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizaitons: Foundations, extensions and new directions* (pp. 3-90). San Francisco: Jossey-Bass.

Kuhn, T., & Corman, S. R. (2003). The emergence of homogeneity and heterogeneity in knowledge structures during a planned organizational change. *Communication Monographs, 70*(3), 198-229. doi:10.1080/0363775032000167406

Kuhn, T., & Jackson, M. H. (2008). Accomplishing knowledge: A framework for investigating knowing in organizations. *Management Communication Quarterly, 21*(4), 454-485. doi:10.1177/0893318907313710

Kuhn, T., & Porter, A. J. (2011). Heterogeneity in knowledge and knowing: A social practice perspective. In H. E. Canary & R. D. McPhee (Eds.), *Communication and organizational knowledge: Contemporary issues for theory and practice* (pp. 17-34). New York: Routledge.

Lam, A. (1997). Embedded firms, embedded knowledge: Problems of collaboration and knowledge transfer in global cooperative ventures. *Organization Studies, 18*(6), 973-996. doi:10.1177/017084069701800604

Lane, P. J., Salk, J. E., & Lyles, M. A. (2001). Absorptive capacity, learning, and performance in international joint ventures. *Strategic Management Journal, 22*(12), 1139-1161. doi:10.1006/smj.206

Langley, A., Smallman, C., Tsoukas, H., & Van de Ven, A. H. (2013). Process studies of change in organization and management: Unveiling temporality, activity, and flow. *Academy of Management Journal, 56*(1), 1-13.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge.

Lavie, D., & Rosenkopf, L. (2006). Balancing exploration and exploitation in allaince formation. *Academy of Management Journal, 49*(4), 787-818.

Lee, H., & Choi, B. (2003). Knowledge management enablers, processes, and organizational performance: An integrative view and empirical examination. *Journal of Management Information Systems, 20*(1), 179-228. doi:10.1080/07421222.2003.11045756

Leonardi, P. M. (2007). Activating the informational capabilities of information technology for organizational change. *Organization Science, 18*(5), 813-831. doi:10.1287/orsc.1070.0284

Leonardi, P. M. (2009). Crossing the implementation line: The mutual constitution of technology and organizing across development and use activities. *Communication Theory, 19*(3), 278-310. doi:10.1111/j.1468-2885.2009.01344.x

Leonardi, P. M. (2014). Social media, knowledge sharing, and innovation: Toward a theory of communication visibility. *Information Systems Research, 25*(4), 796-816. doi:10.1287/isre.2014.0536

Leonardi, P. M., Huysman, M., & Steinfeld, C. (2013). Enterprise social media: Definition, history, andprospects for the study of social technologiesin organizations. *Journal of Computer-Mediated Communication, 19*(1), 1-19. doi:10.1111/jcc4.12029

Leonardi, P. M., & Treem, J. W. (2012). Knowledge management technology as a stage for strategic self-presentation: Implications for knowledge sharing in organizations. *Information and Organization, 22*(1), 37-59. doi:10.1016/j.infoandorg.2011.10.003

Levin, D. Z., & Cross, R. (2004). The strength of weak ties you can trust: The mediating role of trust in effective knowledge transfer. *Management Science, 50*(11), 1477-1490.

Levina, N., & Vaast, E. (2005). The emergence of boundary spanning competence in practice. Implications for implementation and use of information systems. *Mis Quarterly, 29*(2), 335-363.

Lewis, K., Lange, D., & Gillis, L. (2005). Transactive memory systems, learning, and learning transfer. *Organization Science, 16*(6), 581-598. doi:10.1287/orsc.1050.0143

Lin, H. (2007). Effects of extrinsic and intrinsic motivation on employee knowledge sharing intentions. *Journal of Information Science, 33*(2), 135-149. doi:10.1177/0165551506068174

Llewellyn, N., & Hindmarsh, J. (2013). The order problem: Inference and interaction in interactive service work. *Human Relations, 66*(11), 1401-1426. doi:10.1177/0018726713479622

Ma, M., & Agarwal, R. (2007). Through a glass darkly: Information technology design, identity verification, and knowledge contribution in online communities. *Information Systems Research, 18*(1), 42-67.

Majchrzak, A., Faraj, S., Kane, G. C., & Azad, B. (2013). The contradictory influence of social media affordances on online communal knowledge sharing. *Journal of Computer-Mediated Communication, 19*(1), 38-55. doi:10.1111/jcc4.12030

Majchrzak, A., More, P. H. B., & Faraj, S. (2011). Transcending knowledge differences in cross-functional teams. *Organization Science*. doi:10.1287/orsc.1110.0677

Marabelli, M., & Newell, S. (2014). Knowing, power and materiality: A critical review and reconceptualization of absorptive capacity. *International Journal of Management Reviews, 16*(4), 479-499. doi:10.1111/ijmr.12031

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*(1), 71-87. doi:10.1287/orsc.2.1.71

March, J. G., & Olsen, J. P. (1976). *Ambiguity and choice in organizations*. Universitetsforlaget: Bergen.

March, J. G., & Simon, H. A. (1958). *Organizations*. New York, NY: Wiley & Sons.
Mason, R. O., & Apte, U. M. (2005). Using knowledge to transform enterprises. *Transforming Enterprise: The Economic and Social Implications of Information Technology*, 131.
McDermott, R. (1999). Why information technology inspired but canot deliver knowledge management. *California Management Review, 41*(4), 103-117.
Merritt, D. T., Ackerman, M. S., & Hung, P. (2016). Expertise finding. In J. W. Treem & P. M. Leonardi (Eds.), *Expertise, communication, and organizing* (pp. 100-122). Oxford, UK: Oxford University Press.
Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information sharing and team performance: A meta-analysis. *Journal of Applied Psychology, 94*(2), 535-546. doi:10.1037/a0013773
Morgeson, F. P., & Hofman, D. A. (1999). The structure and function of collective constructs: Implications for multilevel research and theory development. *Academy of Management Review, 24*, 249-265.
Nelson, R., & Winter, S. (1982). *An evolutionary theory of economic change*. Cambridge, MA: Belknap Press.
Nevo, D., & Wand, Y. (2005). Organizational memory information systems: A transactive memory approach. *Decision Support Systems, 39*(4), 549-562. doi:10.1016/j.dss.2004.03.002
Nicholls, A. (2009). 'We do good things, don't we?': 'Blended value accounting' in social entrepreneurship. *Accounting, Organizations and Society*, *34*(6–7), 755-769. doi:10.1016/j.aos.2009.04.008
Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science, 5*(1), 14-37. doi:10.1287/orsc.5.1.14
Nonaka, I. (1996). A dynamic theory of organizational knowledge creation. *Organization Science, 5*(1), 14-37. doi:10.1287/orsc.5.1.14
Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company*. New York: Oxford University Press.
Nonaka, I., & Toyama, R. (2007). Strategic management as distributed practical wisdom (phronesis). *Industrial and Corporate Change, 16*(3), 371-394. doi:10.1093/icc/dtm014
O'Dell, C., & Grayson, C. J. (1998). If only we knew what we know: Identification and transfer of internal best practices. *California Management Review*, *40*(3), 154.
Ocasio, W. (1997). Towards an attention-based view of the firm. *Strategic Management Journal, 18*(S1), 187-206.
Okhuysen, G. A., & Bechky, B. A. (2009). Coordination in organizations: An integrative perspective. *Academy of Management Annals, 3*, 463-502. doi:10.1080/19416520903047533
Okhuysen, G. A., & Eisenhardt, K. M. (2002). Integrating knowledge in groups: How formal interventions enable flexibility. *Organization Science, 13*(4), 370-386.
Orlikowski, W. J. (2002). Knowing in practice: Enacting a collective capability in distributed organizing. *Organization Science, 13*(3), 249-273. doi:10.1287/orsc.13.3.249.2776
Orlikowski, W. J. (2006). Material knowing: The scaffolding of human knowledgeability. *European Journal of Information Systems*, *15*(5), 460-467. doi:10.1057/palgrave.ejis.3000639
Osterloh, M., & Frey, B. S. (2000). Motivation, knowledge transfer, and organizational forms. *Organization Science, 11*(5), 538-550. doi:10.1287/orsc.11.5.538.15204

Østerlund, C., & Carlile, P. (2005). Relations in practice: Sorting through practice theories on knowledge sharing in complex organizations. *Information Society, 21*(2), 91-107. doi:10.1080/01972240590925294

Oxley, J. E., & Sampson, R. C. (2004). The scope and governance of international r&d alliances. *Strategic Management Journal, 25*(8-9), 723-749. doi:10.1002/smj.391

Padgett, J. (1980a). Bounded rationality in budgetary research. *The American Political Science Review, 74*(2), 354-372.

Padgett, J. (1980b). Managing garbage can hierarchies. *Administrative Science Quarterly, 25*(4), 583-604.

Palazzolo, E. T. (2005). Organizing for information retrieval in transactive memory systems. *Communication Research, 32*(6), 726-761. doi:10.1177/0093650205281056

Penrose, E. T. (1959). *The theory of the growth of the firm*. Oxford: Oxford University Press.

Pentland, B. T. (1995). Information systems and organizational learning: The social epistemology of organizational knowledge systems. *Accounting, Management and Information Technologies, 5*(1), 1-21.

Phelps, C. (2010). A longitudinal study of the influence of alliance network structure and composition on firm exploratory innovation. *Academy of Management Journal, 53*(4), 890-913. doi:10.5465/amj.2010.52814627

Polanyi, M. (1961). Knowing and being. In K. Grene (Ed.), *Knowing and being: Essays by michael polanyi* (pp. 123-137). Chicago: University of Chicago.

Polanyi, M. (1962). Tacit knowing: Its bearing on some problems of philosophy. In M. Grene (Ed.), *Knowing and being: Essays by michael polanyi* (pp. 159-180). Chicago: University of Chicago.

Polanyi, M. (1966). *The tacit dimension*. Garden City, NY: Doubleday.

Poole, M. S., & Van de Ven, A. H. (1989). Using paradox to build management and organization theories. *Academy of Management Review, 14*(4), 562-578. doi:10.5465/AMR.1989.4308389

Power, M. (2001). Imagining, measuring and managing intangibles. *Accounting, Organizations and Society, 26*, 691-693.

Raisch, S., Birkinshaw, J., Probst, G., & Tushman, M. L. (2009). Organizational ambidexterity: Balancing exploitation and exploration for sustained performance. *Organization Science, 20*(4), 685-695. doi:10.1287/orsc.1090.0428

Rheinberger, H. (1997). *Toward a history of epistemic things: Synthesizing proteins in the test tube*. Stanford, CA: Stanford University Press.

Ruggles, R. (1998). The state of the notion: Knowledge management in practice. *California Management Review, 40*(3), 80. doi:10.2307/41165944

Sampson, R. C. (2007). R&d alliances and firm performance: The impact of technological diversity and alliance organization on innovation. *Academy of Management Journal, 50*(2), 364-386. doi:10.5465/AMJ.2007.24634443

Schatzki, T. R. (1996). *Social practices: A wittgensteinian approach to human activity and the social*. Cambridge: Cambridge University Press.

Schultze, U., & Leidner, D. E. (2002). Studying knowledge management in information systems research: Discourses and theoretical assumptions. *Mis Quarterly, 26*(3), 213-242. doi:10.2307/4132331

Schumpeter, J. A. (1934). *The theory of economic development*. Cambridge, MA: Harvard University Press.

Sharma, A. (1997). Professional as agent: Knowledge asymmetry in agency exchange. *Academy of Management Review, 22*(3), 758-798.

Shotter, J., & Tsoukas, H. (2014). Performing *phronesis*: On the way to engaged judgment. *Management Learning, 45*(4), 377-396. doi:10.1177/1350507614541196

Simon, H. A. (1997). *Administrative behavior* (4th ed.). New York, NY: Free Press.

Singh, J. (2005). Collaborative networks as determinants of knowledge diffusion patterns. *Management Science, 51*(5), 756-770. doi:10.1287/mnsc.1040.0349

Smith, D. E. (2001). Texts and the ontology of organizations and institutions. *Studies in Cultures, Organizations and Societies, 7*(2), 159-198. doi:10.1080/10245280108523557

Sole, D., & Edmondson, A. (2002). Situated knowledge and learning in dispersed teams. *British Journal of Management, 13*(S2), S17-S34. doi:10.1111/1467-8551.13.s2.3

Spender, J. C. (1994). Knowing, managing and learning: A dynamic managerial epistemology. *Management Learning, 25*(3), 387-412. doi:10.1177/135050769402500302

Spender, J. C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal, 17*(S2), 45-62. doi:10.1002/smj.4250171106

Spender, J. C., & Grant, R. M. (1996). Knowledge and the firm: Overview. *Strategic Management Journal, 17*, 5-9.

Star, S. L., & Strauss, A. (1999). Layers of silence, arenas of voice: The ecology of visible and invisible work. *Computer Supported Cooperative Work (CSCW), 8*(1), 9-30. doi:10.1023/A:1008651105359

Starbuck, W. H. (1992). Learning by knowledge-intensive firms. *Journal of Management Studies, 29*(6), 713-740. doi:10.1111/j.1467-6486.1992.tb00686.x

Stark, D. (2009). *The sense of dissonance: Accounts of worth in economic life*. Cambridge, MA: Princeton University Press.

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision-making - biased information sampling during discussion. *Journal of Personality and Social Psychology, 48*(6), 1467-1478. doi:10.1037/0022-3514.48.6.1467

Steinel, W., Utz, S., & Koning, L. (2010). The good, the bad and the ugly thing to do when sharing information: Revealing, concealing and lying depend on social motivation, distribution and importance of information. *Organizational Behavior and Human Decision Processes, 113*(2), 85-96.

Strauss, A., Fagerhaugh, S., Suczek, B., & Wiener, C. (1985). *Social organization of medical work*. Chicago: University of Chicago Press.

Suchman, L. (2000). Making a case: 'Knowledge' and 'routine' work in document production. In P. Luff, J. Hindmarsh, & C. Heath (Eds.), *Workplace studies: Recovering work practice and informing system design* (pp. 29-45). Cambridge: Cambridge University Press.

Suddaby, R., & Greenwood, R. (2001). Colonizing knowledge: Commodification as a dynamic of jurisdictional expansion in professional service firms. *Human Relations, 54*(7), 933-953. doi:10.1177/0018726701547007

Szulanski, G. (1996). Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic Management Journal, 17*(S2), 27-43. doi:10.1002/smj.4250171105

Szulanski, G. (2000). The process of knowledge transfer: A diachronic analysis of stickiness. *Organizational Behavior and Human Decision Processes, 82*(1), 9-27. doi:10.1006/obhd.2000.2884

Teece, D. J. (1998). Capturing value from knowledge assets: The new economy, markets for know-how, and intangible assets. *California Management Review, 40*(3), 55.

Treem, J. W., & Barley, W. C. (2016). Explaining the (de)valuation of process experts in contemporary organizations. In J. W. Treem & P. M. Leonardi (Eds.), *Expertise, communication, and organizing* (pp. 213-231). Oxford: Oxford University Press.

Treem, J. W., & Leonardi, P. M. (2012). Social media use in organizations: Exploring the affordances of visibility, editability, persistence, and association. *Communication Yearbook, 36*, 143-189. doi:10.2139/ssrn.2129853

Tsoukas, H. (2009). A dialogical approach to the creation of new knowledge in organizations. *Organization Science, 20*(6), 941-957. doi:10.1287/orsc.1090.0435

Tsoukas, H., & Vladimirou, E. (2001). What is organizational knowledge? *Journal of Management Studies, 38*(7), 973-993. doi:10.1111/1467-6486.00268

Uzzi, B., Mukherjee, S., Stringer, M., & Jones, B. (2013). Atypical combinations and scientific impact. *Science, 342*(6157), 468-472. doi:10.1126/science.1240474

Vaast, E., & Walsham, G. (2005). Representations and actions: The transformation of work practices with it use. *Information and Organization, 15*, 65-89.

Van de Ven, A. H., & Poole, M. S. (1995). Explaining developments and change in organizations. *Academy of Management Review, 20*(3), 510-540. doi:10.5465/AMR.1995.9508080329

Vásquez, C., Schoeneborn, D., & Sergi, V. (2016). Summoning the spirits: Organizational texts and the (dis)ordering properties of communication. *Human Relations, 69*, 629-659. doi:10.1177/0018726715589422

Venkitachalam, K., & Willmott, H. (2017). Strategic knowledge management: Insights and pitfalls. *International Journal of Information Management, 37*(4), 313-316. doi:10.1016/j.ijinfomgt.2017.02.002

Volberda, H. W., Foss, N. J., & Lyles, M. A. (2010). Absorbing the concept of absorptive capacity: How to realize its potential in the organization field. *Organization Science, 21*(4), 931-951.

Wang, S., & Noe, R. A. (2010). Knowledge sharing: A review and directions for future research. *Human Resource Management Review, 20*(2), 115-131. doi:10.1016/j.hrmr.2009.10.001

Wasko, M. M., & Faraj, S. (2005). Why should i share? Examining social capital and knowledge contribution in electronic networks of practice. *Mis Quarterly, 29*(1), 35-57.

Weber, M. (1978). Beuraucracy. In G. Roth & C. Wittich (Eds.), *Economy and society* (pp. 956-1005). Berkeley, CA: University of California Press.

Wegner, D. M. (1987). Transactive memory: A contemporary analysis of the group mind. In G. Mullen & G. Goethals (Eds.), *Theories of group behavior* (pp. 185-208). New York: Springer-Verlag.

Wenger, E., & Snyder, W. M. (2000). Communities of practice: The organizational frontier. *Harvard Business Review, 78*(1), 139-+.

Wiig, K. M. (1997). Knowledge management: Where did it come from and where will it go? *Expert Systems with Applications, 13*(1), 1-14. doi:10.1016/s0957-4174(97)00018-3

Winter, S. G., & Szulanski, G. (2001). Replication as strategy. *Organization Science, 12*(6), 730-743. doi:10.1287/orsc.12.6.730.10084

Wittenbaum, G. M., Hollingshead, A. B., & Botero, I. C. (2004). From cooperative to motivated information sharing in groups: Moving beyond the hidden profile paradigm. *Communication Monographs, 71*(3), 286 - 310.

Yates, D., & Paquette, S. (2011). Emergency knowledge management and social media technologies: A case study of the 2010 haitian earthquake. *International Journal of Information Management, 31*(1), 6-13. doi:10.1016/j.ijinfomgt.2010.10.001

Yuan, Y. C., Fulk, J., Monge, P. R., & Contractor, N. (2010). Expertise directory development, shared task interdependence, and strength of communication network ties as multilevel predictors of expertise exchange in transactive memory work groups. *Communication Research, 37*(1), 20.

Zack, M. H. (1999). Developing a knowledge strategy. *California Management Review, 41*(3), 125-+.

Zucker, L. G., Darby, M. R., & Armstrong, J. (1998). Geographically localized knowledge: Spillovers or markets? *Economic Inquiry, 36*(1), 65-86.

Table 1

Four Trajectories of Knowledge in Organizations and Their Prevalence In Our Sample (count, % of sample)

		T_1	
		Integrated Knowledge	Differentiated Knowledge
T_0	Integrated Knowledge	1. Maintaining Common Ground (16 papers, 8%) *Exemplar:* Internal boundary work (Aldrich, 1971)	4. Producing Specialization (25 papers, 12.5%) *Exemplar:* Divisionalization (Galbraith, 1973)
	Differentiated Knowledge	2. Producing Common Ground (169 papers, 84.5%) *Exemplar:* Overcoming interpretive barriers (Dougherty, 1992)	3. Maintaining Specialization (46 papers, 23%) *Exemplar:* Summarization & uncertainty absorption (March & Simon, 1958)

Figure 1: Prevalence of each trajectory within our sample

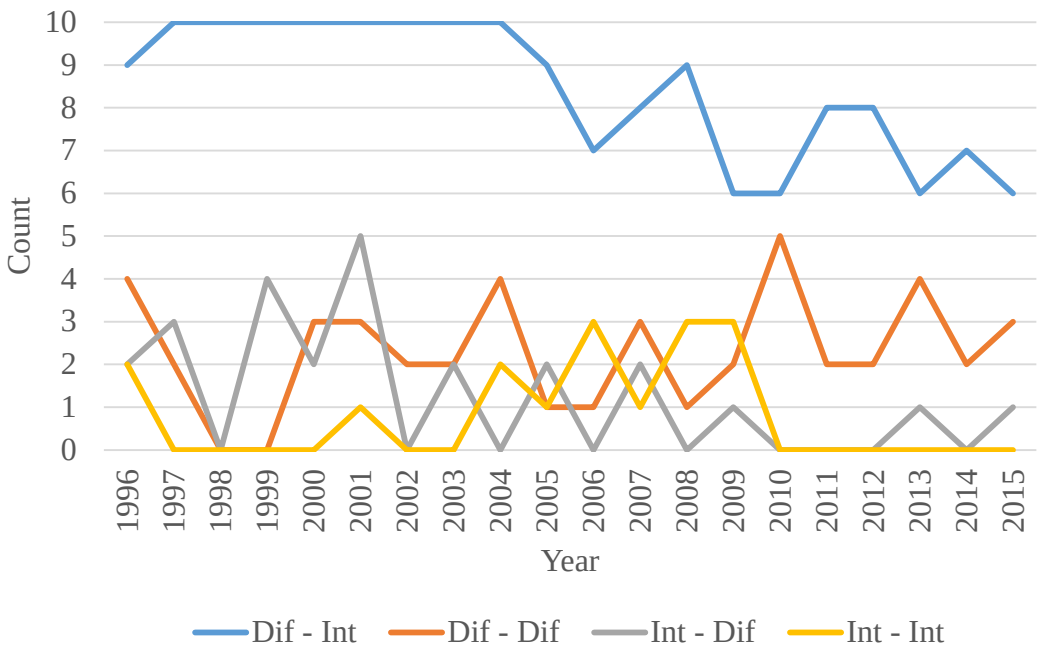
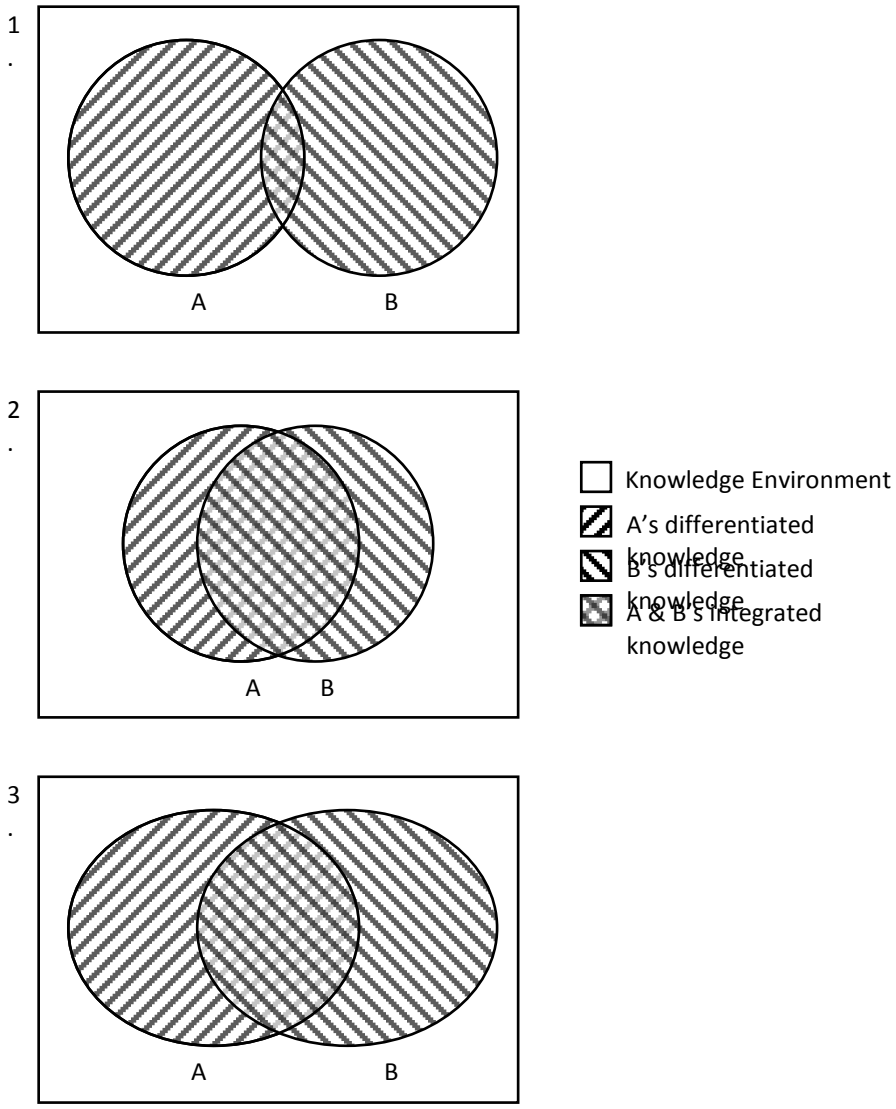


Table 2
Three Strategic Directions for KM research

Approach	Research Direction:	Related Research Questions:
Acknowledging the value of uncommon ground	Evaluating which knowledge to share	o How do experts determine what *not* to share in a particular opportunity for engagement? o How can organizations support, reify, and codify these processes? o Under what conditions is the development of interactional expertise operationally efficient?
Investigating practices of differentiated knowing	Uncovering "invisible" work in KM	o How does the invisible interactive work conducted by human and nonhuman participants develop and promulgate assessments (i.e., metrics and indicators) of knowledge and knowledge work? o How, through those interactions, do particular interests become inscribed into those assessments? o Are particular forms of practice associated with an emphasis on either common ground or specialization in KM?
	Heterogeneity in knowledge and knowing	o How does knowledge/knowing heterogeneity produce practices that reframe and/or challenge existing KM initiatives? o How do efforts to engage heterogeneity foster or inhibit the innovative management of integration-differentiation tensions?
Viewing KM as a process of organizational change	Temporality in KM as organizational change	o How do actors' interpretations and uses of KM tools shift over time? o How do changes in interpretations and uses of KM tools influence processes of knowledge integration or differentiation?
	Knowledge networks	o Do differential types of actors (human and non-human) or relations influence processes of knowledge integration and differentiation in different ways? o How does knowledge integration or differentiation at one level of an organizational network influence KM processes at another level of the network? o How does the articulation of an organizational knowledge network, and associated meta-knowledge, provided by KM efforts influence processes of knowledge integration or differentiation?

Figure 2: The tension between differentiated and integrated knowledge



Note: Panel 1 illustrates two organizational units with highly differentiated knowledge. Note that the total area of the environment they cover is quite large. Panel 2 illustrates two units with a large amount of integrated knowledge at the cost of conceptual breadth. Put formally: As $A \cap B$ increases, $A \cup B$ decreases. Panel 3 illustrates a contingency where the two units increase integration while preserving differentiated knowledge. Note how doing so requires each subunit to maintain awareness of a larger area of its knowledge environment.