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COMMUNITY LEARNING IN INFORMATION TECHNOLOGY INNOVATION[1]

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Abstract

In striving to learn about an information technology innovation, organizations draw on knowledge resources available in the community of diverse interests that convenes around that innovation. But even as such organizations learn about the innovation, so too does the larger community. Community learning takes place as its members reflect upon their learning and contribute their experiences, observations, and insights to the community's on-going discourse on the innovation. Community learning and organizational learning thus build upon one another in a reciprocal cycle over time, as the stock of interpretations, adoption rationales, implementation strategies, and utilization patterns is expanded and refined. We advance an overall model of this learning cycle, drawing on two community-level theories (management fashion and organizing vision), both of which complement the dominant emphases of the literature on IT innovation and learning. Relative to this cycle, we then empirically examine, in particular, the dependence of community learning on organizational learning. Sampling the public discourse on enterprise resource planning (ERP) over a 14-year period, we explore how different kinds of organizational actors can play different roles, at different times, in contributing different types of knowledge to an innovation's public discourse. The evidence suggests that research analysts and technology vendors took leadership early on in articulating the "know-what" (interpretation) and "know-why" (rationales) for ERP, while later on adopters came to dominate the discourse as its focus shifted to the "know-how" (strategies and capabilities). We conclude by identifying opportunities for further inquiry on and strategic management of community learning and its interactions with organizational learning.

Keywords: Information technology innovation, innovation community, community learning, learning-about, discourse, management fashion, organizing vision

Introduction

Researchers studying information technology innovations have recently shown considerable interest in organizational learning. This interest has been spurred primarily by the increasing belief that knowledge is among the most valuable of organizational assets. As an integral aspect of organizations' efforts to innovate with IT, learning helps organizations acquire the knowledge necessary for deploying and using new

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technologies (Attewell 1992). Empirical studies of IT innovations usually portray learning as learning-by-doing, which often begins when an organization adopts an IT innovation (e.g., Ang et al. 1997; Ke and Wei 2006; Salaway 1987). However, even before an organization adopts an innovation, a learning challenge already exists in the lack of knowledge about the innovation's characteristics, its potential benefits, and the demands posed by its implementation and utilization. For example, numerous organizations adopted enterprise resource planning (ERP) systems in the 1990s. Many adopters, despite paying millions of dollars for software and services, found out that implementing ERP was still extremely difficult, and that they did not have sufficient capabilities to implement and operate it (Davenport 1998). Recent research has revealed that only certain performance metrics show evidence of improvement after ERP implementation, and even these metrics take about three years to show improvements (Poston and Grabski 2001). Had firms known of the possibility of such limited benefits and such lengthy delays, would they have chosen to adopt ERP in the first place? Where adoption was undertaken, would pre-adoption knowledge of the substantial difficulty have helped firms be more prepared to innovate with ERP?

Research taking the learning-by-doing perspective usually does not address this pre-adoption knowledge barrier, but we believe that learning as a knowledge creation practice must overcome this barrier. In this paper we call the type of learning that takes place before or without material engagement with the innovation *learning-about*.

But how can organizations learn about an IT innovation without materially engaging with it? In our view, they can learn about innovations by making sense of information that arises from what others have said and written about the innovation. Organizations learn about new IT from outside sources such as trading partners, consultancies, the media, and universities. The multiplicity of knowledge sources available to organizations seeking to learn about an IT innovation speaks to the reality that the innovation is associated with heterogeneous and interdependent interests. These interests converge in an interorganizational collective (Swanson and Ramiller 1997) which, because of its focus on communication and interpretation, is usefully regarded as a *discourse* community (Swales 1990). In this community, some talk and write about the innovation; some learn about it by listening and reading; and some do both. In a reciprocal fashion, then, as some organizations learn about an IT innovation from the discourse of a larger community, others' reflection on the experiences with the innovation can be fed back into the community discourse. Hence, the community learns as its members learn, in a cycle that builds knowledge on both the organizational and community levels over time.

Considering the theoretical and practical significance of such dual-level learning, in this study we aim to address the research question: *How do organizations and discourse communities interact in learning to innovate with IT over time*? We have three goals: (1) to make the analytical distinction between learning-by-doing and learning-about and to promote the latter as an interesting subject in IT innovation learning research; (2) to take the initial step to understand learning-about by modeling how community learning supports and feeds upon organizational learning; and (3) to explore key elements of the model by empirically studying how different organizational actors contribute different types of knowledge to community learning over time. The current paper broadens the IT innovation learning literature along two dimensions: Toward learning-about as a complement of learning-by-doing, and toward community learning as an extension of the traditional attention to group and organizational learning. Our empirical study of various organizational actors' contributions to the discourse about ERP begins the work of exposing the dynamic patterns reflected in organizational inputs to community learning.

We begin by reviewing the learning perspective in IT innovation research. We then visit some foundational ideas concerning community learning, and introduce the concept of *learning-about* as the central activity that joins organizational learning and community learning. We also explore a typology for the knowledge with which participants engage when learning-about. We then propose a conceptual model of the interactions that constitute this reciprocal, dual-level organizational/community learning. Next, we report on an empirical study that explores selected key elements of the model. Based on the systematic changes we have found in the community discourse over time, we articulate a set of conjectures. Finally, after discussing the study's limitations and directions for future research, we conclude with implications for practice.

IT Innovation Research Meets the Learning Perspective

Over the past two decades, IT innovation research has increasingly examined learning as an integral aspect of organizations' efforts to innovate with IT (see the review by Robey et al. 2000). In this section, we revisit the theoretical basis for the learning perspective in IT innovation research and highlight the main emphases in that perspective. We discuss how those emphases may be broadened and complemented by recent innovation theories. This will set the stage for us to introduce the concepts of learning-about and community learning.

Learning to Innovate with IT

An IT innovation is an information technology perceived as new by the adopting organization (Rogers 2003; Swanson 1994). Our perspective on innovation hence is oriented toward adopters.[2] Organizations innovate with IT by applying new IT to their business processes. Innovating with IT, according to Swanson and Ramiller (2004), is a journey that involves four core processes: comprehension, adoption, implementation, and assimilation. First, organizations collect and interpret information from their environments about the existence and basic idea of an IT innovation. Second, this comprehension effort informs organizations' decisions on whether to adopt the innovation, plus the articulation of supporting rationales. Third, where adoption is actually pursued, the innovation is deployed—hardware and software are installed, business processes are changed, users are trained, and so on. Finally, in due course the innovation becomes assimilated into the routines of organizational work systems.

Adopters of IT innovations often face significant challenges in acquiring the knowledge needed to understand and utilize the innovations effectively (Attewell 1992; Fichman and Kemerer 1997), not least of which because *learning* is needed across all four processes in the innovation journey. In comprehension, organizations must make sense of the information about an innovation in order to achieve some basic understanding (e.g., what the innovation is, why organizations should adopt it, and how it might be implemented and used). In adoption, organizations must assess the innovation's purpose, benefits, and technical features, and identify the organizational problems and/or opportunities to which the innovation might be applied. In implementation, organizations must identify the capabilities required for deploying the innovation in the specific context of their work processes and structures. Various individuals and groups interacting with the innovation need to learn, accept, and/or modify it. Organizational changes are often necessary. Lastly, in assimilation, routine use and a thorough understanding make the innovation a part of organizational memory, that is, the institutionalized bundle of knowledge pertinent to an organization's operation and management (Nelson and Winter 1982). In sum, organizations innovating with IT undertake learning to bridge the gap between what they already know and what the new technology requires them to know (Fichman and Kemerer 1997).

[2]Another main perspective on innovation is focused on the providers of innovations, commonly seen in the business strategy literature (see, e.g., Christensen 1997).

Therefore, the learning process is crucial to the outcome of IT innovations (Ke and Wei 2006). Indeed, empirical studies have found that organizational learning processes help to facilitate the development of IT innovations (Salaway 1987), lower the knowledge barriers to the adoption and assimilation of the innovations (Attewell 1992; Fichman and Kemerer 1997), overcome difficulties in implementing the innovations (Argyris 1977), and enhance organizations' overall performance outcomes from innovating (Tippins and Sohi 2003).

This vibrant literature on learning in IT innovation research has two dominant emphases. First, most studies in this stream have examined learning at the work group or organizational level (e.g., Bondarouk 2006; Lyytinen and Robey 1999). Second, the literature on learning is dominated by the learning-by-doing perspective (Salaway 1987), which posits that the learner (e.g., an individual, group, division, or organization) learns from the experience of *materially* engaging with the innovation during implementation and assimilation.

Despite their theoretical and practical utilities, we assert that the emphases on group or organizational learning and learning-by-doing do not fully address other important dimensions of learning where serious challenges exist for organizations innovating with IT. Entertaining these additional dimensions will carry us toward a more comprehensive definition of learning.

Various definitions have guided scholarly inquiry into organizational and group learning (Nicolini and Meznar 1995). One is that "an entity learns if, through its processing of information, the range of its potential behaviors is changed" (Huber 1991, p. 89). This definition was in part inspired by Friedlander's (1983) observation that "learning may result in new and significant insights and awareness that dictate no behavioral change....The choice may be not to reconstruct behavior but, rather, to change one's cognitive maps or understandings" (p. 194). Friedlander's and Huber's perspective reminds us that learning may not always lead to changes in what organizations do. Where IT innovation is concerned, learning can change an organization's cognitive maps about new IT without invoking any action. This happens especially where the organization rejects certain technologies and continues using existing ones. If an effect on doing does not fully encompass or signal all learning, then why should doing be the only focus of research on learning? There are many ways to change "one's cognitive maps or understandings." Indeed, Huber's broad definition fits with numerous types of learning proposed in the literature: learning-by-doing (Arrow 1962), learning-by-using (Rosenberg 1976), single- and double-loop learning (Argyris and Schön 1978), higher and lower level learning (Fiol and Lyles

1983), exploration and exploitation (March 1991), and environmental scanning (Choo 2001). Inadvertently buried in these many types, however, is the distinction between learning-by-doing and learning without doing. We call the latter *learning about*.

Consider, for instance, what Attewell (1992) called *signaling*, the communication about an innovation as an instance of initial learning-about and an early element in what we have labeled the comprehension process. Attewell argued that signaling is no longer a limiting factor for innovation because "information about the existence of new production technologies and their benefits is widely broadcast by manufacturers' advertisements, by specialized business journals, and by trade associations" (p. 5). He held that signaling is, therefore, relatively unproblematic. However, we believe this conclusion should be revisited. The availability of information does not imply an easy uptake of an innovation. The truth is that the very proliferation of information about new technologies poses a cognitive load on organizations, as they try to comprehend the innovation prior to material engagement. The challenge is compounded by the absence of direct experience with the innovation.

The learning-by-doing perspective in research has developed in a reciprocal way with organization or group level analyses of learning. After all, it is the organization or group (along with its constituent individual members) that learns by doing. However, as we add learning-about to our scope of concerns, we move toward a more expansive, multilevel view of learning than the one present in the current IT innovation literature. The recognition of signaling points to this shift in perspective. Innovation signals come from many sources, as mentioned earlier. These entities constitute a supra-organizational infrastructure that supports the comprehension of technological innovations (Van de Ven and Garud 1993). An organization innovating with IT not only learns through its own learning-by-doing experience, but also from others' interpretations of the innovation that become available through information channels and repositories that reach across and beyond the organization's boundaries.

In short, the field has much to gain from exploring the types of learning that complement learning-by-doing and that take place beyond the organizational level. Two recently developed theories provide useful foundations for such an exploration. One is the theory of management fashions, and the other is theory on organizing visions for IT innovations. These theories lay out key dimensions of learning that previous literature on IT innovation learning has largely overlooked: namely, learning without doing and learning from multiple sources of discourse across and beyond organizational boundaries. We review the two theories next.

Management Fashion Theory

Management fashion theory emerged from the work of scholars studying the diffusion of popular management techniques. Abrahamson and Fairchild (1999) defined a management fashion as a relatively transitory collective belief, "disseminated by the discourse of management-knowledge entrepreneurs, that a management technique is at the forefront of rational management progress" (p. 709). Management fashion theorists conceptualize the supra-organizational environment for learning about innovations as a *knowledge marketplace*, populated by various knowledge entrepreneurs (e.g., consultants, journalists, scholars) and the prospective adopters of management techniques. Learning-about is indeed an important part of this marketplace: Knowledge entrepreneurs sell various ideas about an innovation to organizations eager to obtain the benefits and reduce the uncertainty associated with the innovation. Some types of knowledge entrepreneurs are faster than others in bringing the ideas to the marketplace. For example, in a longitudinal case study of quality circles (QC), Abrahamson and Fairchild (2001) found that technicians were the first to introduce ideas about QC to the knowledge marketplace, followed by the consultants, journalists, and scholars. This implies that some actors follow others, and some ideas may be reused by different actors at different times. Such differentiation further suggests that timing and knowledge sources may impact the process and outcomes of learning about innovations.

As part of the learning process, the entrepreneurs produce enthralling discourse to promote certain innovations as efficient solutions to important problems in organizations (Abrahamson 1996). A fashion emerges, then, where these entrepreneurs' discourses converge on a certain technique, and it begins to attract a substantial amount of attention and popularity, often out of proportion to the benefits from actually using it. This disconnect between actions (adopting a management technique) and outcomes (realizing the benefits as promoted) occasions what Levitt and March (1988) called *superstitious learning*. Evidence for superstitious learning was found in Abrahamson and Fairchild's (1999) study of quality circles. As seen in that case, emotionally charged and unreasoned discourse characterizes the upswings of management fashion waves, whereas more reasoned and qualified discourse characterizes their downswings.

IT innovations, of course, have fashionable aspects. Although management fashion theorists are primarily concerned with administrative techniques, their definition of fashion is broadly applicable to IT innovations such as expert systems, client-server computing, and, more recently, ERP and CRM (customer relationship management). Where the community

discourse reaches a level that sustains a transitory collective belief that an IT innovation is at the cutting-edge, it can become a fashion of the type that Abrahamson and his colleagues describe.[3]

IT fashions present challenges both to industry participants' learning and to scholarly theorizing. In both cases, the *quality of learning* is the crux of the issue. As for industry participants, when an IT innovation comes into fashion, organizations may mindlessly jump on the bandwagon by adopting it with at best a superficial understanding of what it is and how it may be used (Swanson and Ramiller 2004). Anecdotal evidence shows that such organizations sometimes subsequently find the adopted IT to be useless; in other cases they may find it extremely difficult to implement and consequently delay its deployment or even abandon it. Such lack of understanding speaks both to the foolish behavior of individual organizations, and to the failure of the knowledge market to generate the knowledge needed for organizations to learn about the innovation in an adequate and timely way. The genesis of the knowledge market failure, of course, is in part that fad-mongering organizations that have learned little about the innovation have little useful knowledge to contribute to the larger discourse. Or, after painstaking learning, firms fail to contribute the lessons they have learned to the community. As a consequence, the discourse may be replete with wishful thinking, rather than knowledge.

On the side of theorizing, IT fashions raise the crucial issue of how we determine what qualifies as knowledge in the discourse. To the degree that an innovation is fashionable, much of the content of the discourse may initially consist of unqualified speculation and outright hyperbole (Ramiller 2001, 2006). The semantics of the word *knowledge* in this context is unquestionably a problematic issue. However, for our purposes here, it is unnecessary to validate knowledge claims in the discourse independently. Instead, what is important is what the participants themselves ***take*** for knowledge at a particular point in time, even if some of that "knowledge" subsequently proves, with growing experience, to be false.

To summarize, management fashion theory offers a valuable conceptualization of important features of learning-about, including the market environment for learning beyond the organization and the segmentation in that environment. However, although IT fashion poses challenges for the practice and theory of learning, it is over-simplistic to dismiss the collective learning involved as entirely superstitious. Recent work on organizing visions for IT has outlined a process that suggests that much of the learning involved can be quite real.

Organizing Vision Theory

Reflecting on the constitution and diffusion of IT innovations, Swanson and Ramiller (1997) depicted any IT innovation as an emergent phenomenon that originates and evolves as a diverse interorganizational community creates and elaborates an *organizing vision* for it. The organizing vision represents a collective and (to a degree) convergent view for applying IT in organizations in a certain way and to certain ends. The learning undertaken by any prospective adopter organization, according to this theory, is tied to the learning unfolding in the larger community. The vision, as a conceptual framework for an innovation, helps to facilitate the innovation's diffusion by interpreting and legitimating it, and by mobilizing associated material activity.

An organizing vision, as a set of ideas developed by members of a community, clearly entails learning. Reciprocally, for any organization wanting to learn about an IT innovation, the organizing vision offers, in broad strokes, collectively constructed knowledge about benefits, costs, and implementation approaches. To be clear, such community-based learning is not a substitute for learning by each prospective adopter organization. Nor is an organizing vision a substitute for the adopter's own innovation knowledge based in its own specific situation. An organization innovating *mindfully* with IT will feed community knowledge into its own learning processes that are grounded in organizational specifics (Swanson and Ramiller 2004).

Like management fashion theory, organizing vision theory offers a useful conceptualization of the segmented communities that emerge around various IT innovations. Unlike management fashions—temporary collective beliefs suspected of exemplifying superstitious learning—organizing visions go beyond mere fashion statements to synthesize and carry community wisdom that may draw from or support real learning. However, research from the organizing vision perspective has so far focused on the socio-technical dynamics at the community level (e.g., Currie 2004) or on how organizations tap into community knowledge (e.g., Swanson and Ramiller 2004). The reciprocal question is how the community itself can be said to learn. How, specifically, does the community associated with the organizing vision develop its knowledge? Although organizing vision theory has not expressly addressed the details of such learning, the theory

[3]It is important to note that coming into fashion does not imply that the innovation is without practical merit.

does note that the community produces and sustains the organizing vision through its on-going discourse (Swanson and Ramiller 1997), in which diverse organizations participate with or without direct experiences with the innovation. This suggests that research on the interaction between organizational and community-based learning should study the community's discourse.

In summary, even as the learning perspective has grown in importance in IT innovation research and practice, the dominant emphases on group- or organizational-level learning and on learning-by-doing can benefit from an expanded consideration of *learning-about* and *community learning*. Theories on management fashions and organizing visions provide helpful foundations for advancing the learning perspective in these ways.

Community Learning: Some Key Distinctions

In order to address our research question regarding the interaction of organizational and community learning, we need to speak more fully to the issue of community learning presently underexplored in IT innovation research, and entertain distinctions that we will find useful in building a conceptual model. We begin by discussing what we mean by *community*.

The Innovation Community

The *innovation community is a set of organizations with interests in the adoption, implementation, and assimilation of a specific IT innovation*.[4] Such a community emerges to make sense of the innovation and to develop an organizing vision for it. The collection of actors in the community evolves dynamically, as the collective attention to the innovation evolves. The community dissolves once the collective attention disappears. Hence activities in the community constitute a kind of "public project" that, once expired, takes the community with it. Members of an innovation community come from various industries and share a focus on the innovation, but they are differentiated by the particular interests that motivate them. Their interests are indeed diverse: Vendors want to sell their products; consultants want to sell their services; journalists want readers for their magazines and ads; prospective adopters want to make sense of the innovation and, ultimately, to make strategic choices. While diverse, these interests are also interdependent. For one thing, many community members are materially interdependent, participating in a mutually reliant value network made up of suppliers, intermediaries, and customers. There is also a kind of interpretive interdependence, because each member's understanding of the innovation is dependent on and subject to the "cycles of interpretation" taking place in the larger community (Swanson and Ramiller 1997). This interpretive interdependence points to learning as a community undertaking—an idea we will turn to next.

Community Learning

With regard to how communities learn, two approaches have been employed to study the *collective* nature of learning: learning ***in*** a collective and learning ***by*** a collective (Lawson 2000). In learning *in* a collective, the learner belongs to an epistemic community (e.g., a working group, organization, industry, profession, nation-state, etc.). Common knowledge existing in the collective enables interactions among the learners, and it is through these interactions that each learner creates new knowledge. In learning *by* a collective, as the participants learn, they encode their experiences and knowledge into artifacts possessed by the collective, including documents, software, and replicable routines. The collective itself, then, can be said to learn, not merely as a simple summation of what its individual members have learned, but also by means of the artifacts that it produces and utilizes. In the context of our interest in learning by a collective, the constituent learners are organizations and the individuals who belong to, and help to constitute, those organizations. The collective, then, is the innovation community.[5]

Learning by an innovation community is tied inexorably to discourse, as Bruner (1996) notes when he remarks: "Knowledge is what is shared within discourse, within a 'textual' community" (p. 57). The community can then be considered a discourse community, because "talk" in various forms is such an integral activity within this kind of collective. More formally, the innovation community fits closely Swales' (1990) characterization of a discourse com-

[4]We adopt this concept from organizing vision theory. We recognize that this concept has kinship with such notions as "innovation community" for technology commercialization (Lynn et al. 1996), "organizational community" in ecological theory (e.g., Astley 1985), "organizational field" in institutional theory (DiMaggio and Powell 1983), and "actor network" in actor-network theory (e.g., Callon 1991; Latour 2005).

[5]There exist research efforts that explore learning by other types of collectives such as groups or communities of individuals (e.g., Lave and Wenger 1991), organizational populations (e.g., Miner and Haunschild 1995), and geographic regions (e.g., Asheim 1996).

munity, a definition often quoted in prior research employing discourse analysis. Swales defines a discourse community as a collective that has a broadly agreed set of common goals, has mechanisms of intercommunication among its members and an established set of communicative proceedings and practices, uses its participatory mechanisms mainly to provide information, has acquired a specialized lexicon (terminology, acronyms), and has a critical mass of members with "a suitable degree of relevant content and discoursal expertise" (pp. 24-27).

If the innovation community is accordingly a collective that learns through discourse, more needs to be said about the nature of this learning. In the next section, we discuss the concept of *learning-about*, first as a process that organizations engage in and then, in the section that follows, as an accomplishment of the larger community.

Learning About

As discussed above, learning does not necessarily assume doing. We are again calling the type of learning without doing learning-about. Learning-about and learning-by-doing are conceptually different processes. In learning by doing, with an IT innovation, a learner (a person or a social aggregate such as a group or firm) gains knowledge by implementing or operating the technology. In learning ***about*** an IT innovation, a learner gains knowledge by making sense of information that is available apart from material engagement with the technology.[6] Consider web services, for example. By reading articles and books and attending conferences, one can in fact learn a lot, for instance, *about* the enabling standards and protocols, basic architecture, potential applications, and implementation issues. Of course, to become an adopter of Web services, one will have to go further and learn *by doing* web services, for example, by developing, implementing, and using web services.

Learning about an IT innovation takes place primarily through an organization's engagement with the innovation's discourse. This implies that organizations can learn without doing. But not only ***can*** organizations learn without doing; under certain conditions they ***must***. Confronted with a plethora of IT innovations, an organization simply cannot learn by doing all of them. Moreover, the organization often learns about a new IT innovation before deciding to venture into learning by doing it. At this *comprehension* phase in its engagement with the innovation, then, an organization must learn through exposure to others' ideas and experiences. Besides the prospective adopters, other organizations such as news agencies, research firms, and universities may never engage with an IT innovation materially, but to fulfill their own missions related to the innovation, they learn about it through discourse.

There are at least two qualifications we need to make about the distinction between learning-about and learning-by-doing. First, while the sequence of learning-about followed by learning-by-doing sounds plausible for adopter organizations, it is not the only possible sequence. For instance, an organization may experiment with a new technology by doing a pilot first and then consult public discourse to assess its own experience. Episodes of learning-about and learning-by-doing may also alternate cyclically over time, one setting the stage for the other.[7] Further, just because learning-about and learning-by-doing are *conceptually* distinctive does not mean they have to be separate from each other in practice. Many times an organization may engage in both learning-about and learning-by-doing at the same time, so that the two are intertwined.

Besides the established emphasis on learning-by-doing in the IT innovation literature, more scholarly attention to learning-about is warranted, for three reasons. First, thousands of information technologies exist that organizations can learn about, but any organization, however resourceful, can only afford to experiment with, adopt, and use a relatively small set of technologies. This suggests that researchers who focus only on learning-by-doing are overlooking a great proportion of the innovation-related learning actually carried out in organizations.[8] Indeed, instances of learning-by-doing associated with actual adoption and implementation are comparatively rare. Meanwhile, quite common are organizations surveying new IT as discussed in public and private discourse and evaluating the implications of the technologies for organizational operation and management.

Second, learning about IT innovations is far from unproblematic. Prospective adopters struggle over a variety of issues: Which innovations should we invest in learning about? Where and from whom should we learn? How can we evaluate the claims that pass for knowledge?

[6]Our distinction between learning-by-doing and learning-about is based on Bruner's (1996) distinction between learning-to-be and learning-about. In the context of education, one can learn *about* many professions, but learning to *be* a member of a profession requires the learner to do what members of that profession do.

[7]We thank an anonymous reviewer for suggesting this point.

[8]We thank the associate editor for suggesting this point.

Third, what organizations learn (or fail to learn) about an innovation helps shape the conditions for their learning-by-doing. For example, in light of the checkered history of ERP implementations, it seems likely that many organizations would have been better prepared to proceed with ERP if they had learned more *about* this innovation up-front, and particularly about the substantial difficulty and business upheaval entailed (Davenport 1998).

The particular issue of *evaluating claims* while learning about an IT innovation becomes especially salient where an IT innovation becomes a *fashion* among organizations (Abrahamson 1996). In the past several decades, many IT innovations have undergone extreme swings in popularity. When an IT innovation is widely believed to be at the cutting-edge and poised for a massive wave of adoptions, organizations may be prone to take a leap of faith without learning enough about the innovation (Slater 1995). Lacking a sufficient understanding going in, such organizations may later find the IT to be useless or dysfunctional, or discover that it requires special, hard-to-find skills to implement. Hence, for want of learning-about, implementation of an innovation may be delayed (Fichman and Kemerer 1999) or it may fail totally (May 2003). Aggregated across the economy, insufficient learning-about likely contributes in a significant way to the billions of dollars spent every year on unused or abandoned IT (May 2003).

Community Learning-About

Organizational learning about, in the way we have described it here, "scales up." As individual organizations learn about an innovation by tapping the community discourse, their reciprocal contributions, along with the contributions of those more materially engaged in learning-by-doing, feed back into the discourse so that it becomes richer, more substantial, and more nuanced. In this way, we can also say that the community learns-about the innovation.

It is by now commonplace that in learning about an innovation, an organization must scan its environment by seeking and analyzing information (Choo 2001). Here we argue that "the environment" consists substantially of the discourse that embodies knowledge already at varying degrees of development. For that reason, when scholars who study the process of environmental scanning ponder the *analyzability* of the environment (Choo 2001), we view that analyzability as dependent, in part, on the extent and quality of the environment's own encoding of knowledge.

The learning-about we postulate for the innovation community is similar to other notions of learning by supra-organizational, or environmental, entities in the sense that the environmental entities encode knowledge into their artifacts (e.g., discourse or practice). For instance, research on population-level learning examines the "systematic change in the nature and mix of routines in a population of organizations" (Miner and Haunschild 1995, p. 115). Recent research on industrial districts explores mechanisms through which the districts transform into "learning regions" (Asheim 1996). And, of course, industry-level learning involving multiple organizational populations can be inferred as an integral part of the codevelopment of industry and innovation in cases of radical technological innovation (Van de Ven and Garud 1993). These kinds of extensions usefully reveal the complicated learning mechanisms through which organizations learn from each other. Interorganizational learning involves not a simple sender-to-receiver transmission (Ingram 2002), but sophisticated processes mediated by environmental entities such as populations, geographic regions, and the communities of interests examined here.

On the other hand, unlike streams of environment-learning research that emphasize *doing* and the related integration of material action across organizations, our emphasis here on innovation *discourse* speaks to the integration of interpretive work. One important implication of this focus has to do with the high *mobility* of knowledge. The heterogeneous organizations that come together in the innovation community do not always interact with one another materially, but what they write and say about the innovation has the potential to range widely and affect other organizations that are geographically or socially distant. In short, unlike locally circumscribed material actions, texts are highly mobile across both space and time. Texts are also plastic, allowing for multiple readings by multiple organizations (Taylor and Van Every 1993). Knowledge explicitly encoded in discourse, enjoying this combination of mobility and adaptability, thus readily transcends organizational, regional, or industrial boundaries.

Types of Knowledge the Community Learns-About

In a final set of preliminary distinctions, we consider the different types of knowledge that innovation communities encode into their discourse. Making distinctions among knowledge types will help to uncover an important dimension of variation in the community learning process. Furthermore, for the practical purpose of managing such learning, understanding the different properties of knowledge types will help manage various types differently (Bohn 1994).

Among the numerous attempts to identify different types of knowledge, perhaps the best known is the distinction between

tacit and explicit knowledge (Polanyi 1966). Tacit knowledge cannot be expressed in words, whereas explicit (or codified) knowledge can. As learning-about is essentially a discursive process, we give our attention to explicit knowledge that can be codified in community discourse. Sustained efforts in innovation research have shown that there are indeed different types of knowledge serving different purposes and that each type serves the function that other types cannot (Garud 1997; Hamel 2006; Lundvall and Johnson 1994; Swanson and Ramiller 2004). For example, Swanson and Wang (2005) found that, in order to achieve success in innovating with ERP systems, firms need not only technical know-how but also what they called *know-why*—proper adoption rationales grounded in business benefits.

The distinction between these knowledge types, however, does not apply universally. Garud (1997) suggested that making such a distinction depends on the level of abstraction. For example, know-why at one level of generality may represent know-how at a deeper level of specificity. Hence it is important to anchor the discussion at some level of analysis. Additionally, we note that knowledge types also depend on the identities of those having the knowledge. In an IT innovation community, for instance, vendors' knowledge of *how* an IT innovation works may be translated into adopters' knowledge of *what* the innovation is. For this reason, besides the level of analysis, discussion of knowledge types should also reflect the perspective of a specific category of community participants. With such precautions in mind, and adopting the most widely recognized categories for knowledge (especially after Garud 1997; Hamel 2006; Lundvall and Johnson 1994; Swanson and Ramiller 2004), we propose that the IT innovation discourse incorporates three broad, interdependent types of knowledge:

- *Know-what*: interpretations of the principles, features, or components of the innovation
- *Know-why*: rationales for the adoption of the innovation
- *Know-how*: strategies/capabilities for adopting, implementing, or assimilating the innovation

This simple typology[9] applies at both levels of community and organizational learning. Moreover, it focuses on the adopter's perspective.

[9]To these we might add *know-when* (Swanson and Ramiller 2004; Swanson and Wang 2005). Know-when has to do with the proper timing of an organization's engagement with the innovation, and may depend on (1) the maturity of the enabling technology (Leonard-Barton 1988a; 1988b), (2) the state of development of complementary technologies and services (Attewell 1992), and (3) the adopting organization's internal readiness.

Thus far, we have achieved our first goal of distinguishing between learning-by-doing and learning-about and promoting the latter as a research subject. Next, we pursue our second goal by employing the distinctions we have made to develop a model that situates community learning formally in relation to the processes entailed in learning-about and learning-by-doing.

Situating Community Learning: A Dual-Level Conceptual Model

We have proposed that even as organizations (adopters, vendors, research firms, consultancies, and trade journals) draw on the larger innovation community's discourse in order to learn about an IT innovation, the contributions those organizations make to that discourse produce community learning. The overall result is a dual-level process that, over time, builds up the knowledge collectively available.[10] Figure 1 encapsulates our view of this cycle.

Walking through the figure, we begin with community knowledge being utilized by organizations in their learning-about (arrow 1), through exposure to the innovation's public discourse. Community learning also influences organizational learning-by-doing (arrow 2), as knowledge available in the wider community is actively used in innovation projects. Learning-by-doing and learning-about interact within organizations: Learning-about sets the broader framework, provides motivation, and supports the planning for actions the organization undertakes (arrow 3); learning-by-doing leads reciprocally to updating of the organization's own discursive grasp of know-what, know-why, and know-how (arrow 4). Finally, organizational knowledge affects the larger collective knowledge in discursive contributions through creative reflections on the learning-about encoded in the discourse itself (arrow 5) and reports on the learning-by-doing that arises in actual experiences (arrow 6). Knowledge contributions to the community discourse may come *directly* from organizations' learning-by-doing (e.g., adopter, consultant, or vendor experience; arrow 6) or learning-about (e.g., research analyst or journalist report; arrow 5), or stem *indirectly* from knowledge passing through other flows (e.g., adopters modifying their conception of the innovation based on the results of pilot projects and then contributing the modified frame-

[10]While this study focuses on the interaction between organizational and community learning, we acknowledge that learning-about is a type of learning activity at the individual, group, organizational, and community levels. It should be an interesting effort to examine and theorize learning at multiple levels in future research.

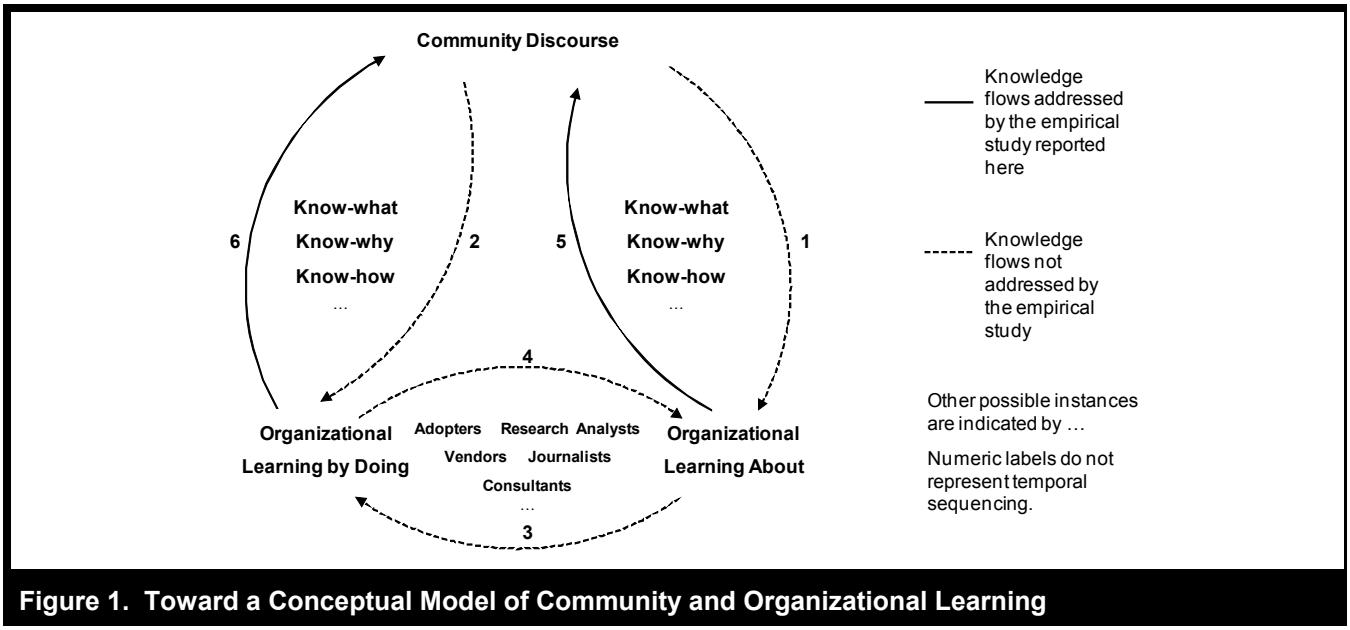


Figure 1. Toward a Conceptual Model of Community and Organizational Learning

work to the community; arrow 4 and then 5). The numbering in Figure 1 is not meant to express sequential ordering. Instead, taking the community as a whole, we would expect the flows in the figure to occur in any order and possibly at the same time.

The model in Figure 1 is, we believe, a helpful starting point for identifying opportunities for studying the relationships between organizational learning and community learning, and for considering the progressive development in the types of knowledge crucial to the application of IT innovations. Moving on to our next goal, we report on an empirical study to explore how different actors contribute different types of knowledge to community learning, as represented in Figure 1 by arrows 5 and 6. This focus speaks to the problem, noted earlier, of previous research having overlooked how the community sources knowledge from organizational learning.

Patterns in Community Learning: Exploring ERP

Among questions about community learning that are of potential interest, and that might manifest themselves in patterns in the wider discourse, are these: What knowledge gets encoded in the discourse? Who contributes this knowledge? How do the knowledge and the sources of that knowledge evolve as experience with the IT innovation grows and (in some cases) the innovation passes in and out of fashion?

In an effort to explore these issues, we conducted an empirical study of the community discourse associated with ERP. As an IT innovation, ERP makes a good subject for two reasons. First, the innovation community for ERP has been large, diverse, and "talkative." Since ERP was introduced in 1990, many organizations have been directly involved in the design, production, implementation, and assimilation of ERP systems (e.g., vendors, consultants, and adopters); others have been keen to study, evaluate, and analyze the ERP concept, products, services, and market (e.g., research analysts, journalists, and academics). Together, the community these actors formed based on their diverse but interdependent interests generated substantial discourse. Second, ERP offers an interesting tension and conflicting evidence, when it comes to the accomplishment of community learning. On the one hand, consultancies and the trade press have been criticized for fanning the flames of ERP through exaggerated claims (Slater 1995), while companies have been blamed for imprudently jumping on the bandwagon without understanding the cost and challenges (Davenport 1998). On the other hand, there has also been much talk of "lessons learned" from implementation and assimilation (Keller 1999).

Methods

In setting about to analyze the discourse on ERP, we sought to relate shifting patterns in the language used to evolution in the broader socio-technical context. This undertaking called

for some form of discourse analysis in a broad sense.[11] Discourse analysis takes language "to be not simply a tool for description and a medium of communication (the conventional view), but as a social practice, as a way of doing things" (Wood and Kroger 2000, p. 4). Accordingly, discourse analysis entails "the analysis of language as it is used to enact activities, perspectives, and identities" (Gee 1999, p. 4) often in a structured and systematic manner (Phillips and Hardy 2002). This approach stresses the interrelationships between language and the social order (Fairclough 2003). Discourse analysis and other language-based approaches remain underutilized in Information Systems (Lacity and Janson 1994; however, note Klein and Truex 1996). In management scholarship more broadly, discourse has come somewhat more to the forefront (see Phillips et al. 2004), a development that possibly foreshadows a greater prominence in IS.

Many works utilizing discourse analysis engage in the close-up and rich analysis of particular texts (Fairclough 2003). Our interests, by contrast, called for a longitudinally expansive view that would, on the linguistic side, command attention to a broad sampling of texts and, on the social side, support discovery of shifting patterns in participation within the discourse community. Details on our methodological approach follow.

An IT innovation discourse manifests itself in a variety of channels or *forums* (Porter 1992), including such obvious ones as the trade press, conferences, advertisements, training sessions, and academic publications. We chose to consider the discourse on ERP through its expression in the trade press—mainly because of the obvious convenience and accessibility of this channel.

Our focus, in analyzing published articles on ERP in the trade press, was to identify instances of knowledge and their contributors as attributed by the authors of the articles. We selected articles for analysis from the ABI/INFORM Global™ database (ABI hereafter). Providing indexing and images of over 2,700 publications on business and technology topics, ABI is frequently utilized for discourse studies (e.g., Abrahamson and Fairchild 1999; Wang and Swanson 2007). We searched ABI and selected articles according to three criteria (Saunders et al. 2003). First, the term *enterprise resource planning* had to appear in the title, abstract, or subject of the article. Second, we selected articles only from practitioner publications. Academic publications were set aside in recognition of the reality that these are mostly read only by academics themselves (Benbasat and Zmud 1999).[12] In contrast, trade publications reach a broader audience. Previous research has found that the trade press is an important and useful source for innovation knowledge (e.g., Watson 1990).[13] Moreover, content analyses have routinely shown that articles in the trade press contain important messages that do not merely reflect but also shape organizational stakeholders' behavior (e.g., Ranganathan and Brown 2006). Third, given that organizational IT innovation was our main interest, we selected articles that addressed primarily the comprehension, adoption, implementation, or assimilation of ERP in organizations.

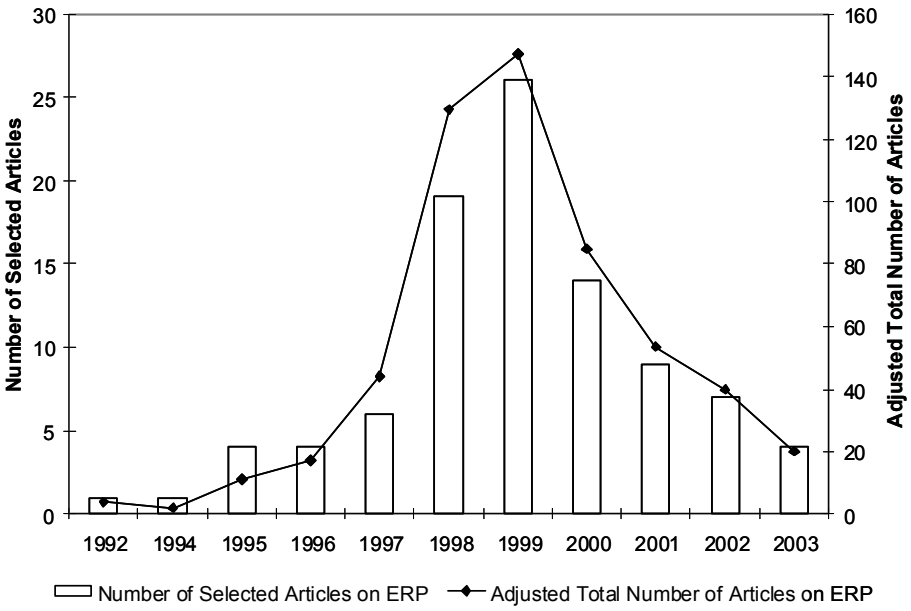
The first author and a research assistant read the abstracts of the articles published between 1990 and 2003 meeting the first two criteria and independently selected those focusing on organizations (either generalized or specific) innovating with ERP. We subsequently retained articles that both raters selected as featuring ERP. In this process, we eliminated articles that mentioned ERP only in passing or described topics not related to organizations innovating with ERP (such as ERP vendor stock performance). Among the 233 articles meeting the above three criteria, we randomly selected 100 for further analysis. Figure 2 indicates that our selection is representative of the overall trend in the volume of ERP discourse captured by ABI.

To identify instances of knowledge embedded in the discourse, we employed a typology that distinguishes between the three main categories of knowledge noted earlier: *know-how*, *know-why*, and *know-what* (again, from the adopter's perspective and at the dual levels of community and organization). Starting with these main categories, two coders (the coauthors) read the full text of the 100 selected ERP articles in random order, and developed subcategories for each main

[11] Although various definitions of discourse analysis exist in the literature (e.g., Fairclough 2003; Phillips and Hardy 2002; Titscher et al. 2000; Wood and Kroger 2000), in labeling our work in this way, we invoke what these definitions share, which is the notion that discourse is a social action or practice that constructs social reality.

[12] Academics can make significant contributions to the broader community discourse through alternative channels such as classroom lectures, conference presentations, books, and the like.

[13] However, we acknowledge the counter-argument made by Rulke et al. (2000), who suggest that the trade press, as a "cheap and easy" channel that involves no direct relationships among organizations, is not an effective source of knowledge to support organizations' learning-by-doing. We suspect, though, that its very accessibility, plus the low effort required to engage with it, may make the trade press a good source for organizations to learn *about* new IT.



Notes:

Please note the different scales used for the "Number of Selected Articles on ERP" and the "Adjusted Total Number of Articles on ERP," as indicated on the left and right vertical axes.

Because ABI itself has grown dramatically over the years, the total number of articles on ERP each year was adjusted to factor out the variations in the total number of articles indexed by ABI. We multiplied the number of ERP articles in a certain year by the ratio between the total number of articles indexed in 1996 and the total number of articles indexed that year.

Figure 2. Yearly Number of Selected Articles and Total Number of Articles on ERP in ABI

category.[14] The subcategories emerged through an iterative process in which each successive article was coded independently, new codes were created as needed, and the two coders then worked to reconcile their evolving coding schemes (Barley et al. 1988; Saunders et al. 2003). A hierarchical coding scheme (see Appendix) stabilized after coding the first 32 articles. These articles were then recoded using the final coding scheme. The coders then coded the remaining 68 articles in three batches. After each batch, intercoder reliability statistics were calculated for every article and for the batch. Five articles were dropped due to low reliabilities (< 70%). The reliability for the remaining 95 articles ranged from 75 percent to 100 percent, with a mean of 86 percent. Ruling out coding agreements due to chance, the more stringent reliability measure—Cohen's Kappa (Cohen 1960)—is 0.71, which should be interpreted as "good agreement" (Altman 1991, p. 404).

During the coding process, the first author identified the cited contributors for each coded instance of knowledge, using the categories *adopter*, *consultant*, *journalist*, *research analyst*, and *vendor* (Abrahamson and Fairchild 2001).[15] Once all the articles were coded, the frequencies of every knowledge subcategory, main category, and contributor category in each

[14]Although the classification of text into mutually exclusive categories mimics the customary procedure of content analysis (Krippendorff 2004), we employed it as a structured method for our discourse analysis. We acknowledge a stricter view that content analysis and discourse analysis are mutually exclusive and that the latter does not involve categorization of text because each piece of text is subject to multiple interpretations and categorizations. However, our view is that multiple interpretations may share important commonality that reveals patterns of social reality, and so, some conventional content analysis techniques provide for structured methods for discourse analysis.

[15]Instances from other types of contributors (e.g., academics and industry associations) were negligible. In the relatively rare cases where an article was coauthored and a knowledge instance in the article was attributed to the authors of the article, we recorded the category to which the first author of the article belonged.

article were averaged across the two coders (Barley et al. 1988). For example, one coder identified eight instances of know-how in an article, whereas the other coder identified ten such instances. The average frequency of the know-how category in that article was nine. The average frequency was then divided by the average total number of knowledge instances, producing a percentage score for each category for each article. Because each article provided a unique opportunity for learning, we calculated the percentage of each knowledge category for each article, rather than the percentage of each category across all articles. Following the same example, if the average total number of knowledge instances for the article was 30, then the percentage score for the know-how category for the article was 30 percent (9 divided by 30). The percentage scores of every category for all articles published in the same period (defined below) were further averaged to produce a category percentage for the period. For instance, the percentage score for the know-how category between 1990 and 1995 was 22 percent, meaning that, on average, 22 percent of the knowledge instances coded in an article published in that period were know-how. Over time, the percentage scores revealed the changing patterns of the knowledge and contributor categories.

Temporal Structure of the ERP Discourse

Since the learning patterns apparently changed during our examination window, we divided the window into periods and investigated the characteristics of each period. Specifically, we marked out three periods: emergence (1990–1995), growth (1996–1999), and maturity (after 2000). We derived and named these stages heuristically based on both the substance of the discourse and widely accepted stage models for industry or product lifecycles (for a review, see Klepper 1997), because the industry/product life cycle stages, although not developed for our purpose, are congruent with the distinctive phases of community learning empirically found here.

Period I (1990–1995): Emergence

In the late 1980s, some large manufacturing companies started to express "a great deal of dismay and lack of satisfaction" with the poor functionality in the manufacturing resource planning (MRP II) software offered by IBM, ASK, SSA, and HP (Keller 1999, p. 44). Searching for and evaluating new enterprise software technologies, three analysts at Gartner created a framework for comparing software packages. They named the framework "enterprise resource planning." In April 1990, in its internal publication *Computer Integrated Manufacturing*, Gartner first reported a description of the technological environment and functions of ERP:

> We have crafted a checklist for Enterprise Resources Planning (ERP), which we consider the software architecture for the next generation of MRP II….The environmental issues focus on the continuing evolution of computing systems. One area of initial importance will be the implementation of graphical user interfaces in ERP…data will be structured relationally and will be accessed via SQL calls…. The application software will be designed to take advantage of the client/server model. The package will make extensive use of 4GLs [fourth generation programming languages] in the implementation of the application (Lee Wylie, 1990, Gartner, Research Analyst, *Computer Integrated Manufacturing*, Know-What, Technology Components).[16]

At the beginning, the discourse on ERP was limited to the analysts' work in articulating the ERP concept in their reports (circulated through internal publications) and at conferences. After the Gartner analysts introduced the ERP concept, other players quickly joined the discussion, making contributions to the discourse that concerned what ERP is and how it works:

> The goal is a company where information gets entered into a computer once, and only once. A sales rep, say, books an order for gimcracks and enters it into SAP. After that the software makes sure everyone stays informed. When the factory begins assembling the order, shipping can check its progress online and calculate the expected transport date. The warehouse can check its stock of parts and fill whatever bins the factory has depleted. Once the order gets shipped, the information goes directly into the sales reports for the folks at the top (Ronald Lieber, 1995, Journalist, *Fortune*, Know-What, Working Principle).

Some vendors pondered the design options in producing ERP:

> To actually produce an ERP software package, a vendor has a couple of options. One option is to supply customers with a basic information systems infrastructure, or "open computing environment," and then let other companies write programs that work within the system and its standards. Another approach is to bundle together programs that support different business functions into separate "modules;" then buyers decide which modules to include in their

[16]Features of each quote are presented in this order: the contributor's name, year, role in the community, affiliation (if different from publication), source, and knowledge category and subcategory (if applicable).

> package (Donald A. Hicks, 1995, Vendor, Decision Science Inc., *IIE Solutions*, Know-What, Design Principle).[17]

Vendors inspired by the new concept began to offer ERP software packages, including Xerox's Chess, QAD's MFG/PRO, and SAP's R/3.

> SAP was founded in 1972 by four former IBM employees in Germany. In 1992, SAP came out with a new version of its software that runs on client-server systems [R/3] instead of mainframes, its revenues climbed from $532 million to an estimated $1.5 billion that year. SAP soon became the market leader of ERP. By 1994, SAP had more than three times the market share of its largest competitors (Ronald Lieber, 1995, Journalist, *Fortune*).

However, opportunistic relabeling was also noted: "[MRP II vendors] took the label of ERP, slapped it onto their products, and it was off to the races" (Keller 1999, p. 44).

In addition to interpretations of ERP (know-what), rationales for adopting ERP (know-why) began to appear and came in due course to dominate the ERP discourse in this period. Some early adopters claimed that they adopted ERP to replace their frustrating legacy systems:

> Reaching its present state of ERP use began with a decision by KBI management to literally toss out its problem-plagued legacy system. In 1991, a team rolled the obsolete computer off the roof of the company's headquarters building, and each employee took a turn whacking the pieces of the broken system with a sledgehammer. The whole scenario was captured on videotape (Anonymous, 1991, Adopter, King Bros. Industries, *Manufacturing Systems – MSI*, Know-Why, to Replace Legacy).

Other early adopters turned to ERP as they faced cost and efficiency pressures:

> Easton [a baseball equipment firm] sells its products on technology, but a lot of people aren't buying technology now, they're buying looks and price. So we have to make that $60 bat for $20. How do you do it? You reduce your set-up times; you reduce your waste and scrap; you improve your throughput time—whatever it takes (Kenneth Waltrip, 1995, Adopter, Easton, *Manufacturing Systems*, Know-Why, to Cut Cost, to Improve Efficiency).

Vendors and journalists sometimes offered know-why on behalf of prospective adopters:

> Companies are finding that they require a method of coordinating all the data found in a world wide organisation. MRP II cannot cope (Dinah Greek, 1994, Journalist, *Professional Engineering*, Know-Why, to Integrate Business).

The discourse initially focused on know-what and know-why; attention to know-how emerged more gradually. Research analysts and vendors led the discussion on know-how by raising the issue of package selection:

> We have seen other clients delay ERP implementation because of the lack of robust packages—that has been particularly true of companies with continuous-process or engineer-to-order manufacturing styles. While a few vendors sell functional packages, very few of the current crop will be around in five years (Erik Keller, 1995, Research Analyst, Gartner, *Manufacturing Systems*, Know-How, Fit and Need Determination).

Central to package-selection was the trade-off between integrated and best-of-breed solutions:

> Integrated packages from single vendors are going to require a major up-front investment, but buying different modules from multiple vendors will probably require a lot of effort (read $$$) to get them to work together, and maintenance costs will be higher in the long term (Shaz Horner, 1995, Journalist, Computer Weekly, *IIE Solutions*, Know-How, Best of Breed, End-to-End Solution).

Apart from the burgeoning category of know-how and increasingly obvious know-what, this six-year period was characterized by the variety of claims to know-why that various players used to *justify* ERP as it emerged as an increasingly popular concept and product.

Period II (1996–1999): Growth

Major ERP vendors (SAP, Oracle, PeopleSoft, Baan, and J. D. Edwards) enjoyed dramatic growth in the 1990s. By the end of 1998, more than 60 percent of Fortune 1000 companies had implemented ERP core applications (Stein 1999). ERP,

[17] A clarification on coding: This instance represents the vendor's knowledge of *how* ERP packages should be designed. However, from an adopter's perspective—which, again, is our focus—these design principles correspond to the adopter's knowledge of *what* ERP options are offered for the organization to acquire. So we coded the above knowledge instance as know-what.

as a management fashion, was reaching its full ascendance. In a characteristic piece of IT-innovation hyperbole, Michael Hammer, the eminent *reengineering* guru, called ERP "the most potent and subversive contemporary instrument of business revolution" (Hammer 1999, p. 186). Accompanying the numerous announcements of ERP adoptions and implementations were success and failure stories. Many adopters reported positive outcomes, ranging from successful implementation, to improved technology infrastructure, operations, management, and performance. While these success stories were associated with a variety of adopters, horror stories concentrated on just a few organizations having implementation disasters:

> Texas-based pharmaceutical distributor FoxMeyer Drug actually collapsed following an SAP R/3 implementation, its bankruptcy trustees filed a $500 million lawsuit in 1998 against the German ERP giant [SAP], and another $500 million suit against co-implementer Andersen Consulting (Malcolm Wheatley, 1998, Journalist, *CIO Magazine*).

Who should be blamed? Vendors and consultants were criticized for overselling ERP:

> The most revealing moment [at an SAP conference] may have occurred on a bus full of tipsy sales reps. After brief introductions one rep said to the other, "Hey, I heard you finally got [company X] to sign on the dotted [line]." Second rep: "Yeah. It took a while for them to see the light, though." First rep (laughing): "Now comes the darkness" (loud laughter throughout bus) (Michael H. Martin, 1998, Journalist, *Fortune*).

Meanwhile, adopters were criticized for adopting without adequately knowing why and how:

> One client I was having lunch with was excited about the ERP implementation soon starting at his company. When I asked him why he was embarking on an ERP program, he looked at me in a puzzled way and said, "No one ever asked me that before." After 45 minutes of further discussion, he could still not come up with a reason (Erik Keller, 1999, Research Analyst, Gartner, *Manufacturing Systems*).

The prevalent but flawed view that adoption was justified by the perception that "everyone else is doing it" is illustrated by the following quote:

> So, some may see ERP as a bandwagon. But the problem is that when you have some of the largest companies in the world using ERP, it is sad if you are left behind (John Wolfenden, 1997, Vendor, Fourth Shift, *Professional Engineering*).

However, the discourse simultaneously offered an abundance of reasons for adopting ERP. Some adopters addressed ongoing struggles such as management control:

> But the real reason that many companies are implementing SAP is because management is trying to bring discipline into the organization (Peter W.C. Mather, 1996, Adopter, Air Products and Chemicals Inc., *CIO Magazine*, Know-Why, to Centralize).

Others cited the rise of the Web and the need for ERP as a foundation for e-business. For still others, ERP was a Y2K cure. In this period, vendors' and journalists' contributions of know-why declined significantly, leaving adopters the dominant contributors of know-why discussion.

Adopters also dominated in the emergent know-how category. As more and more adopters were implementing and using ERP, they reported their hard-won lessons (from learning-by-doing) to the community, making know-how the largest knowledge category. The community's concern with know-how spoke to a host of issues, including such matters as package-selection tips, software configuration, organizational change management, project management, and system maintenance. For example, when implementing ERP, some companies customized the software to fit their ways of doing business:

> The PeopleSoft ERP system didn't have a data field for the delivery stop sequence, but it needed to relay that information to the warehousing system [Know-What, Limitation]. To make all the pieces work together, Domino's decided to take the drastic step of modifying the PeopleSoft software to include these fields (Jim Krasner, 1999, Adopter, Domino's Pizza Inc., *CIO Magazine*, Know-How, Customization).

Others preferred refraining from customizing the software by changing their business processes to fit how the software works. Still others suggested a contingency approach:

> MBNA used three criteria for accepting or rejecting customization requests: whether the feature existed in its legacy systems and needed to be duplicated, the complexity of the request, and the ROI (Dick Ho, 1999, Adopter, MBNA Corp., *InformationWeek*, Know-How, Customization).

"To customize or not" was just one of the know-how topics debated in the ERP community. Other frequently contested topics included the extent to which consultants should be used and how hard project managers should be on deadlines. On the other hand, members of the community seemed to have reached consensus on certain other issues; for example, keeping key stakeholders informed was widely accepted as important to implementation success.

As the ERP market grew dramatically, a shortage of skilled implementers opened lucrative implementation service opportunities for the IT consulting industry. Consultancies formed partnerships with ERP vendors. With their experiences in helping clients implement ERP, consultants also contributed know-how to the discourse. For example,

> Managing risk within the changes inherent in ERP implementations involves the development of a method to organize, prioritize, and communicate issues relating to change before, during, and after they occur. The management of these changes is broken down into three risk areas: operating, financial, and information risks (David Cahn, 1997, Consultant, KPMG, *Manufacturing Systems*, Know-How, Risk Management).

In the meantime, journalists continued scouting among adopters for new ways to innovate with ERP. For example, they found more and more organizations "bolting" custom modules on their ERP. Depending on where they drew the boundary of ERP, some called the trend "the second wave of ERP," while others termed it the "post-ERP movement":

> Some of these post-ERP apps—such as sales-force automation, customer relationship management, data mining, and supply-chain management systems—have already emerged. Newer ERP add-ons focus on areas such as demand planning, component management, product data management, and transportation management (Bruce Caldwell, 1998, Journalist, *InformationWeek*, Know-How, Technology Extension, and Know-What, Feature and Functionality).

The notable increase of know-how primarily contributed by adopters in this period's discourse indicated that the ERP concept had been not only *justified*, but also *enabled* as a practical basis for developing products, providing services, and applying in use. In contrast, the basic concept of ERP became increasingly familiar and obvious and, as a result, the volume of discourse dedicated to know-what dropped significantly.

Period III (After 2000): Maturity

From 2000 forward, the ERP product and service market leveled off, and the discourse on ERP started declining (Figure 2), indicating that ERP had become a *mature* technology. As most large companies in manufacturing and logistics had already adopted and implemented ERP, vendors turned to target mid-sized companies and companies in other industries such as financial services and healthcare. A new round of vendor consolidation began (e.g., PeopleSoft's acquisition of J. D. Edwards and Oracle's hostile takeover of PeopleSoft in 2003-04). Some research analysts and journalists continued to capitalize on the ERP concept. In 2001, Gartner introduced ERP II, which expanded beyond "enterprise-centric optimization and transaction processing" to enable firms to participate in collaborative commerce (Genovese et al. 2001).

Meanwhile, community knowledge on how to implement and utilize ERP systems appeared to have converged on a few rule-like principles. For example, adopters were advised to go "best-of-breed," because no single vendor could address all the needs of an organization, while middleware for integrating packages from different vendors had dramatically improved. Moreover, changing business processes was deemed preferable to changing the software code. Also entering as stock knowledge was the dictum that implementing ERP was not just about installing software: Involve everyone, including the users, business managers, and executives, whose sponsorship and leadership are essential.

By 2003, ERP was no longer at the forefront of IT progress. Instead, it had become the "back-office solution" and the "backbone" for business. The dominant theme in the dwindling discourse maintained by those remaining active in the community—mainly vendors and adopters invested in ERP—was the importance of "recognizing that this is a project that never ends."

Knowledge and Participation in the Discourse Community: An Evolutionary View

How did knowledge embedded in the ERP community discourse evolve? Table 1 shows the average percentages of the three main knowledge categories and contributors by period. The table also gives the statistical significance associated with the change between periods.

Looking across the periods, the prevalence of know-how increased remarkably, driven primarily by contributions from adopters, consultants, and journalists. Although the analysts'

Table 1. Evolutions of Knowledge Contributed by Community Members[a]

	Emergence 1990–1995	Growth 1996–1999[d]	Maturity After 2000	Mean
Know-How	**22%**[b]	**60%****	**71%***	**62%**
Adopter	1%[c]	30%**	37%*	31%
Consultant	2%	14%**	15%	13%
Journalist	2%	8%*	11%	9%
Research Analyst	12%	5%*	5%	5%
Vendor	5%	3%	3%	3%
Know-What	**30%**	**8%****	**5%**	**9%**
Adopter	4%	3%	3%	3%
Consultant	7%	1%*	0%	1%
Journalist	3%	3%	1%	2%
Research Analyst	3%	0%	0%	1%
Vendor	13%	1%*	1%	1%
Know-Why	**45%**	**28%****	**23%**	**27%**
Adopter	14%	15%	18%	16%
Consultant	7%	5%	1%	3%
Journalist	10%	5%*	3%	4%
Research Analyst	0%	2%	1%	1%
Vendor	13%	1%*	0%	1%

[a]Percentages may not add up to 100% because some coded knowledge instances belong to other negligible categories (than the three main categories) such as *know-when*.

[b]During 1990-1995, for example, on average 22% of the knowledge instances coded in an article were know-how.

[c]The 22% know-how included 1% from the adopters, for example.

[d]Significance of change from previous period; two-tailed t test (when there are fewer than 30 articles in any period) and two-tailed z tests (when there are 30 or more articles in both periods); *p < .05; **p < .01.

contribution of know-how was dominant during the emergence period, it dropped during growth. In the emergence period, most contributions of know-how were about package selection. Know-how in the later two periods included strategies to manage the implementation and maintenance of ERP systems. Know-why was the largest category in the emergence period, then it decreased, although not as substantially as know-what. In fact, adopters' contributions of know-why increased slightly over the years. Know-what was the second largest category in the emergence period and became the smallest category later on. Adopters' contributions of know-what were relatively stable over time, while vendors and consultants reduced their contributions significantly. As to the subcategories of know-what, most subcategories (e.g., design principle and technology component) decreased proportionally with the main category, except the subcategory limitation, addressing the weakness of ERP, which increased slightly.

Reorganizing the same data, Table 2 shows community members' contributions of knowledge over time. Vendors' dominance in the emergence period faded in the growth and maturity periods, as adopters increased their contributions of know-how. The patterns for consultants and journalists were similar to each other. Their overall contributions of knowledge did not change much across the three periods; their increasing contributions of know-how were offset by their decreasing contributions of know-what and know-why. Research analysts, as the creators of ERP, focused originally on the know-what, but as others were justifying the ERP concept, analysts shifted their attention to the know-how.

In sum, members of the ERP community played different roles in the community learning associated with ERP, as indicated by the differing patterns in their knowledge contributions. Most conspicuously, as ERP gained increasing popularity and experienced dramatic market growth, adopters became the leading contributors of knowledge, particularly know-how.

ERP in the Context of the Conceptual Model

The patterns revealed by the data in Tables 1 and 2 allow us to make some conjectures about the interaction between organizational learning and community learning for ERP over

Table 2. Evolutions of Community Members' Contributions of Knowledge[a]

	Emergence 1990–1995	Growth 1996–1999[d]	Maturity After 2000	Mean
Adopter	**19%**[b]	**50%****	**58%**	**51%**
Know-How	1%[c]	30%**	37%	31%
Know-What	4%	3%	3%	3%
Know-Why	14%	15%	17%	16%
Consultant	**16%**	**20%**	**16%**	**18%**
Know-How	2%	14%**	15%	13%
Know-What	7%	1%*	0%	1%
Know-Why	7%	5%	1%	3%
Journalist	**15%**	**17%**	**15%**	**16%**
Know-How	2%	8%*	11%	9%
Know-What	3%	3%	1%	2%
Know-Why	10%	5%*	3%	4%
Research Analyst	**18%**	**7%****	**6%**	**8%**
Know-How	12%	5%*	5%	5%
Know-What	3%	0%	0%	1%
Know-Why	0%	2%	1%	1%
Vendor	**32%**	**4%****	**3%**	**6%**
Know-How	5%	3%	3%	3%
Know-What	13%	1%*	1%	1%
Know-Why	13%	1%*	0%	1%

[a]Percentages may not add up to 100% because some coded knowledge instances were contributed by other types of members in the community, such as academics and industry associations.

[b]During 1990-1995, for example, adopters contributed on average 19% of the knowledge instances in an article.

[c]The 19% adopters' contribution included 1% know-how, for example.

[d]Significance of change from previous period; two-tailed t test (when there are fewer than 30 articles in any period) and two-tailed z tests (when there are 30 or more articles in both periods); *p < .05; **p < .01.

time. To begin with, in the late 1980s, Gartner analysts learned from the community discourse on MRP II about adopters' increasing dissatisfaction with that innovation (arrow 1 in Figure 1). The analysts then created ERP as the next generation of MRP II, contributing reports to the community discourse to explain the know-what and know-why of ERP (arrow 5). Analysts from other research firms and journalists learned about ERP (arrow 1) and offered their interpretations (arrow 5). In this way, ERP was conceptualized.

More organizations learned about ERP from conferences or the press (arrow 1) and then joined the on-going discussion (arrow 5) about what ERP is and why organizations should adopt it. Some technology vendors began developing and producing ERP products to help instantiate the concept, as they understood it (arrow 3). Based on their learning-by-doing, vendors reported their understanding back to the community (arrow 6). Similarly, some firms, after learning about ERP (arrow 1), adopted it and—informing their learning-by-doing with learning-about (arrow 3)—developed their own insights, which they reported back to the community (arrow 6). The focus of community learning at this point was justification (know-why).

By 1996, ERP had been justified to the satisfaction of many; its popularity was growing; its market was expanding exponentially. More and more adopters contributed their lessons learned (mostly know-how) to the community discourse (arrow 6). Consultants did the same on a smaller scale. Responding to (while helping to promote) an increased demand from their readers, journalists increased their contribution of know-how (arrow 5), in part on the basis of "textual work" that in effect converted the learning-by-doing of their adopter correspondents to learning-about (arrow 4). The discourse on know-how help to enable ERP, which could then more reliably be produced, serviced, purchased, and

used. By the end of 1999, know-what was obvious; know-why became diversified; know-how dominated the discourse.

As ERP matured, the composition of knowledge in the community discourse did not change much from the previous period, but the volume of knowledge contributions subsided, and the real market size for ERP leveled off. On the other hand, knowledge in the community discourse became more coherent, as consensus formed on various issues, relating especially to know-how.

The two solid paths in our conceptual model (arrows 5 and 6 in Figure 1)—which, again, reflect the empirical focus in our exploration of ERP—suggest that *community learning relies on organizational learning (both learning-about and learning-by-doing).* Initially, know-what and know-why coming from analysts' and journalists' efforts to learn-about help conceptualize and justify the new IT. Later on, know-how from adopters' learning-by-doing enables the IT.

Discussion

In this paper, we have presented an argument for the utility of the concept of *community learning* in IT innovation. We have situated such learning in the discourse of the heterogeneous collection of interests that convenes around the possibilities associated with an IT innovation. And we have advanced a conceptual model (Figure 1) to account for how community learning arises from the contributions of its organizational members, as those members learn-about and learn-by-doing, even as the community discourse reciprocally informs their learning.

The contribution of this work, we have asserted, is three-fold. First, it initiates discussion about the possibility of learning at a level that transcends and encompasses the organizational level. That is, much as the literature has established organizational learning as a process constituted by, but having properties distinct from, individual learning (Cohen and Sproull 1995), we believe it is equally useful to recognize community learning as something to which organizations contribute but that stands as a subject of distinctive interest. Indeed, we have argued that *organizational* learning associated with IT innovation will eventually be better understood when it can be placed in the context of learning processes on the community scale.

Second, we promote learning-about as the complement of the more familiar learning-by-doing. Learning-about is crucial in the diffusion and adoption of IT innovations, because it is the means by which organizations tap into and make use of the knowledge embedded in the community discourse. Such knowledge is necessary as organizations decide, in the first place, whether *to do or not to do* an IT innovation; it is also needed for staging and understanding actions subsequently undertaken.

Third, the paper continues the development and application of work on the general characterization of knowledge in IT innovation, specifically the distinctions among know-what, know-why, and know-how. Here, we have demonstrated the utility of this conceptual schema in charting the evolution and dynamics of innovation-related learning at the community level.

The paper has also described an empirical investigation of selected aspects of the reciprocal model of community and organizational learning. The focus was on exploring what might be discovered about patterns in community discourse over time, with respect both to the character of the knowledge manifested in the discourse, and to the types of organizations contributing that knowledge. ERP provided the focal innovation of interest. We observed a three-period community-learning process that begins in a collective preoccupation with conceptualization and justification as the innovation emerges, then advances to enable the innovation as the market for it grows, and finally subsides as the innovation matures. Across this developmental sequence, concerns with know-what and know-why give way to a preoccupation with know-how. Relative to discourse contributors, research analysts constituted an advanced guard, giving early form to the innovation's know-what, and then leading the subsequent inquiry into the know-how. Vendors also spoke early, referring mainly to the know-what and know-why, but then their voice largely faded out from the public discourse. Adopters and consultants made contributions to the deliberations on know-why, with adopters sustaining a concern with this knowledge theme. But adopters and consultants became leading participants especially in connection with know-how.

A crucial question surrounding the empirical study is how generalizable the findings are across innovations. This question helps point the way toward future research, particularly with respect to arrows 5 and 6 in Figure 1. Based on the results in Tables 1 and 2, and prior literature, we offer the conjecture[18] that

[18]Our conjectures are based on the general patterns shown in Tables 1 and 2, but do not in every case correspond to statistically significant pairwise differences, as our interest is in outlining theoretical possibilities for future research.

C1. *Know-why* and *know-what* will dominate the early discourse on an IT innovation, with attention to *know-why* persisting somewhat beyond attention to *know-what*; the discourse will inevitably shift to a primary concern with *know-how*, as the innovation community moves on a widespread basis into material implementation.

On the matter of which comes first to prominence, *know-why* or *know-what*, we are less confident about generalizing. In the case of ERP, the evidence of sequence is not clear-cut, and it may be that as a practical matter articulations of the what and why will always be close companions, despite their analytical distinction. It is hard to imagine much discourse happening about the character of an innovation without an accompanying motivation. At the same time, it seems unlikely there can be much motivational discourse without considerable effort to spell out the innovation that is being promoted. Nevertheless, to the extent that there might be some temporal separation between the two, we speculate that there could be a difference between push and pull innovations. We propose that

C2a. *Know-why* will come to prominence in the community discourse prior to *know-what* in circumstances where a pronounced business need "pulls" along the development and elaboration of an innovation's organizing vision.

C2b. *Know-what* will come to prominence in the community discourse prior to *know-why* in circumstances where the advent of new technology "pushes" the search for compelling business needs to which it can be applied.

When it comes to the distribution of "authorship" in the discourse community over time, we observed in this case the crucial early role played by the research analysts. One interesting opportunity for comparative study lies in investigating exactly how important firms like Gartner, Forrester, and the like have been in promulgating various IT innovations. We suspect that it might well be learned that such firms, in the company of other thought leaders, are surprisingly influential—among the true knowledge entrepreneurs in the field. But is this always the case? To help frame this issue for further consideration, we speculate that

C3a. Research analysts and their firms will sometimes be the originators of organizing visions for information technology; when not literally the initial authors of a vision, they will frequently be those who provide the first public articulation of the corresponding innovation's *know-why* and *know-what*.

Research analysts, however, will quickly move away from know-why and know-what—being able to count on others to pick up these themes (see below). Their attention will be among the first to turn to matters of implementation:

C3b. Research analysts and their firms will turn in short order to the development of advice and counsel on the issue of *know-how*.

In the meantime, we will propose that the vendors of enabling technologies will infrequently originate the concept of an IT innovation, but will be quick to pick up their activities around the advent of significant discourse surrounding the innovation. Their contributions will likely echo the motivations articulated by thought leaders, but will focus primarily on the *know-what*, since it is within this knowledge theme that the technological components they offer must find their fit.

C4. Technology vendors will join the community discourse at a relatively early stage, with their contributions focusing heavily on the innovation's *know-what*.

Consultants, acting as those who advise prospective adopters on matters of investment, will concern themselves with the *know-what* and *know-why*; acting also as those who help committed adopters to implement innovations, they will also speak to the *know-how*. *Know-how* will come to prominence later in the discourse contributions of consultants, as a consequence of the increasing level of engagement by adopters.

C5. Consultants will become active contributors to the community discourse more or less in conjunction with the material engagements of important early adopters; the consultants will follow along behind the research analysts and technology vendors in speaking to the innovation's *know-what* and *know-why*, but will shift in due course to an emphasis on the *know-how*, a theme relative to which they will take a prominent and leading role.

From the ERP data, we propose that adopters will basically leave the articulation of *know-what* to other parties that they would regard as the originators and elaborators of the innovation concept. *Know-why*, on the other hand, is something about which the adopters will have a significant voice in the community discourse. Adopters must create rationales for the innovation relative to their own organizational contexts and so they must tailor the "why" of the innovation sketched in its organizing vision to local circumstances (Swanson and Ramiller 2004). Adopters must do this *ex ante*, as justification for proceeding, but they often must also

rationalize IT investments *ex post*, especially in situations where expectations have been unrealized. As such, we reason that as the cumulative experience of the innovation community grows, adopters will become an increasingly important source of insight concerning the contingencies that define the appropriateness of the innovation to differing organizational settings. Consequently, adopters' *know-why* contributions to the community discourse will often persist well past those of other participants, and may even increase over a considerable period of time. In short,

C6a. Adopters will play a significant role in articulating the innovation's *know-why*; their participation in the community discourse in this regard will persist over time, even as other participants' voices on the issue of *know-why* fade.

Furthermore, adopters will join consultants in having a focal concern with issues of *know-how*. It is in adopter organizations, after all, that an IT innovation is fully realized.

C6b. Adopters will in due course become active contributors to the community discourse on *know-how*, with their prominence increasing as implementation of the innovation becomes more extensive and widespread.

This set of conjectures gives some shape to the possibilities for further inquiry on the dynamics of both the substance of community learning and the character of participation in the innovation discourse. However, our inferences are subject to the limitations of this study.

Limitations and Future Research Directions

The first limitation has to do with the use of trade-journal articles as a data source. Obviously, the trade press is just one of the many forums for the community discourse, and the journalists and publishers behind the trade press are only one of the many types of actors in an innovation community. If we hope to generalize about trends in the larger innovation discourse on the basis of this single source, at issue is to what extent the trade press accurately represents the diversity in community participants and their views. In defense of trade journals, we note that it is in fact their business to actively represent what others have to say about innovations. In this sense, the trade press facilitates not just the trade of innovation products and service, but also the exchange of innovation ideas, claims, and experiences in the knowledge marketplace.[19] We also note that trade journals, while they may sometimes deviate into their own peculiar constructions of reality, are subject to structural constraints that tend to bring them back into line with the interests of influential constituencies.[20] Nevertheless, we do need to acknowledge that our analysis assumes that a larger volume of, say, adopter quotes at a given phase is not simply an artifact of journalists *choosing* to cite adopters for some reason; that is, we have necessarily assumed that the journalists' activity in locating people with things to say has done a largely representative job of sampling the broader community discourse at any point in time. The limitations entailed by the use of the trade press point to one area for future research, namely, determining whether other kinds of communication channels (e.g., industry expositions, conferences, blogs, and wikis) tend to reveal the same patterns of knowledge and participation. Findings from channels more supportive of developing mutual understanding and less directly linked to the exchange of products and services would be especially valuable for comparison. This could help establish the representativeness of trade journals or, alternatively, point toward improved multichannel research methods.

Second, although ERP is an attractive subject for analysis because of its diverse community, voluminous discourse, and dynamic patterns of learning, it is still just one innovation. An extension on the current research—suggested by our conjectures—would be to determine whether other prominent IT innovations exhibit similar patterns. It may well be that some do, while others show distinctively different histories when it comes to the timing of knowledge issues and the distribution, over time, of participation. Variation, if such is found, could become the basis for more sophisticated and contingent theorizing on the relationship between organizational and community learning.

Third, revisiting Figure 1, the solid lines (arrows 5 and 6) correspond to the knowledge flows that the current empirical study has allowed us to draw inferences about. While we argued earlier that these aspects of the model deserve a higher priority for research, the remaining elements of the model point to future possibilities for complementary research.

[19]However, one may argue that the product/service trading function dominates other functions and thus the trade press is biased toward technical rationality (Head 2003).

[20]In an interview unrelated to the current study, the editor-in-chief of a prominent IT trade journal reported that his journal had foolishly persisted with the topic of "pen-based computing" during the 1980s, well beyond the point where other parties had lost interest. The journal, he noted, was eventually brought to heel by corrective feedback from its advertisers and readership.

Thus, we will propose that future research investigate more activities related to the joint community/organizational learning process, as represented by the dashed lines in Figure 1. How, for example, is community knowledge translated and utilized by organizations in their learning-about (arrow 1)? This might call, in part, for intensive fieldwork to investigate the processes by which the larger discourse is incorporated as resource, and act as a constraint in organizations' efforts to develop a locally meaningful vision for the innovation (Swanson and Ramiller 2004). Of interest, also, is whether and how community learning influences organizational learning-by-doing (arrow 2), especially in the context of adopters' on-going efforts in implementation and assimilation. Also, while we have talked speculatively and in general terms about how learning-about helps set the stage for learning-by-doing, there is much to be learned about how these two modes of innovation learning actually interact within organizations (arrows 3 and 4).

Finally, just as any study involving manual coding of qualitative data, our empirical study of sampled articles on ERP cannot completely eliminate threats to reliability. Ambiguity inevitably exists regarding the knowledge category or subcategory to which each piece of text belongs. Aware of this potential issue, we took widely accepted measures to improve reliability, including independent selection and readings of the articles, interactive and consensus-based code development, and phased coding. While our relatively smooth coding process and good inter-coder reliability scores gave us reasonable confidence in our main findings and conclusions, we welcome replications of this empirical study. Further, our analysis does not speak incisively to the *quality* of community learning, or the processes through which knowledge becomes, or fails to become, validated. As the potential for IT fashions and hyperbole testifies, neither community learning nor organizational learning is always successful in generating knowledge. Especially, the dependence of organizations on the community discourse points to the need for future research on qualities in that larger discourse that can indicate when a kind of collective madness is afoot that can affect the fortunes of individual organizations (Ramiller 2006).

Conclusion

The theoretical contributions, conjectures, and future research directions that we have outlined here have practical implications for organizations innovating with IT. Foremost, our emphasis on learning-about encourages innovation practitioners to strategically manage this distinctive, ubiquitous, and useful form of learning. Like learning-by-doing, learning-about entails managerial attention and fostering. Unlike learning-by-doing, the process and context of learning-about primarily involve discourse that is available externally. Managers, we believe, can make more effective use of this resource by being more fully aware of the complex structure and evolutionary dynamics of both the discourse itself and the community that produces it. Such awareness will help in *monitoring* and *assessing* contributions to the discourse. Moreover, it will help to produce opportunities to *selectively contribute to* the discourse. The ultimate value of the community discourse depends on the quality of the contributions by each actor. And while the community discourse unavoidably entails provisional claims and even strategically-motivated distortions, managers' contributions of their knowledge, based on their own organizations' contextualized experience of the opportunities and hazards, can help to improve the quality of learning for all.

This, then, returns us to the core issue motivating the current paper. If managers and their organizations *learn about* an IT innovation in great part by drawing on knowledge created and diffused within a complex, diverse community, then more study is needed of the processes and implications of learning in such communities. Our work here represents a modest step toward the eventual creation of a multilevel learning-based theory to account, in a general way, for the constitution, diffusion, and institutionalization of IT innovations.

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Appendix

List of Selected Codes and Examples

Category	Subcategory	Example of Text Coded
Know-why	To align IT and business	But post-ERP development isn't just about new software. Fundamental to this movement are cultural and organizational shifts intended to align IT and business-management objectives once and for all.
	To cut cost	Dow Chemical, for instance, became an early convert to enterprise systems because it saw them as a way to cut costs by streamlining global financial and administrative processes.
	To integrate business	We had nine different general ledgers and 28 points of customer entry. We had multiple purchasing systems. We had no clue how much volume we were doing with a particular vendor because every factory set up their own vendor masters and purchased on their own.
	To replace legacy	Customers like Kredel also point to the fact that R/3 has been a driver to shed aging mainframes and move on to modern distributed computers.
Know-how	Best of breed	He chose the best-of-breed strategy of choosing multiple vendors and multiple products and hooking them together.
	Change and effect anticipation	From the focus group meetings that we have held, it is apparent that one of the major challenges of our members has been to accurately estimate and communicate the complexity involved.
	Customization	FTI's MIS department can modify the "baseline" software to change screens, reports, programs, file layouts, dictionaries, and menus. As a result, FTI has modified the standard menu and input screens to facilitate data entry and information retrieval-without relying on the ERP vendor for this kind of customization.
	Fit and need determination	A rapidly changing, decentralized company, for example, should not implement R/3, says Russ Maney, a research director with Forrester Research Inc. in Cambridge, MA, "SAP will be nothing but a headache for them."
	Integration technology	The Best project team had overlooked the integration points between the modules. All the purchasing departments now used common names and systems, and followed a common process, but their system was not integrated with the financial, planning or sales groups.
	Project control	The offsite group members eventually decided that to finish the project they would need to begin at the beginning, starting with the business requirements then reaching an end date, rather than trying to fit the project into a mold shaped by a predetermined end date.
	User-business involvement	The CIO shouldn't be left holding the bag. More than anything before it, the SAP revolution has gotten the business community to take responsibility for the business process.
Know-what	Design principle	Most enterprise systems are modular, enabling a company to implement the system for some functions but not for others.
	Limitation	These packages work wonders as long as the "enterprise" falls under the domain of a single vendor's package. But when information needs to cross the border between rival packages, stand back. It's every byte for itself.