Journal of the Association for Information Systems
JAIS

Research Article

Popular Concepts beyond Organizations: Exploring New Dimensions of Information Technology Innovations *

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Abstract

The abundance of innovation concepts in the world of information technology and their differentiated influence on the design, production, and use of IT in organizations make it important that we understand what shapes these concepts themselves. Taking the perspective that an IT innovation concept emerges and evolves beyond organizational boundaries in a community, I argue that the prevalence or popularity of the concept in IT discourse positively influences the adoption of the underlying innovation. Then with the aim to explore what makes an IT innovation concept popular, my empirical analysis of the once highly popular concept ERP (enterprise resource planning) suggests that (1) the popularity of ERP was influenced positively by the prevalence of highlighted business problems that ERP was claimed to solve; (2) ERP's popularity was influenced negatively by the prevalence of related innovation concepts; and (3) these influences largely disappeared after ERP passed its peak popularity. These results imply that the popularity of an IT innovation concept responds to the broader climate of business and relies on the right type of attention drawn and released by other concepts in a network of concepts. Going beyond the dominant paradigm, this paper helps broaden IT innovation research along two new dimensions: toward the innovation concept, as a complement to material innovation, and toward community-level analysis, as an extension of the traditional organizational analysis. The paper also suggests that practitioners evaluate an innovation concept's fit with the broader environment and relationship with other popular concepts, as a way to make sense of the innovation and anticipate its impact on IT practice.

Keywords: *Information technology innovation, innovation concept, discourse, community, popularity, enterprise resource planning.*

* Rob Fichman was the accepting Senior Editor. Angsana Techatassanasoontorn, Kar Yan Tam, and Marie-Claude Boudreau were the reviewers. This paper was submitted on February 12, 2006 and went through three revisions.

Volume 10, Issue 1, pp. 1-30, January 2009

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Guys like me and Hammer just kind of throw this stuff against the wall. Some of it sticks and some doesn't.
— Thomas H. Davenport[1]

1. Introduction

Reflecting on the decline of business process reengineering (BPR), an information technology-enabled concept that he introduced along with Michael Hammer and James Champy in the early 1990s, Thomas Davenport recently lamented the faddishness of the IT world. His expression "to stick" in the quote above means to become highly visible, prevalent, or popular in the on-going discourse about IT. Although numerous concepts like BPR exist, few of them stick. When an IT concept sticks, it often brings about profound innovations in IT practice. Consider knowledge management (KM), which Davenport popularized with Laurence Prusak a few years after BPR was introduced. The KM concept emerged to become a highly popular topic across the trade and popular press and the subject of much academic research. KM has been translated into an $8.8 billion worldwide market for software vendors and consultants (Malhotra, 2005) and one of the most important corporate performance-enhancement initiatives.[2] When an innovation concept fails to stick, i.e., when it fails to attain a certain level of popularity in IT discourse, the failure tends to forestall the development and diffusion of related material innovations.

Despite so much at stake, the dominant paradigm for IT innovation research is primarily focused on the adoption of new IT in the *material*, rather than *conceptual*, form. An IT innovation in the conceptual form can be referred to as an *IT innovation concept*, which I define as a *collective idea for the development and utilization of an IT innovation*. Either BPR or knowledge management, for example, represents a concept that broadly addresses what the innovation is, why organizations should undertake the innovation, and how to do so. In contrast, an IT innovation in its material form corresponds to the physical aspects such as hardware, software, and the processes enabled. Thus far, there has been little sustained research to understand who creates IT innovation concepts, how they are developed, why some concepts become highly popular but others don't, and what different concepts may entail for the adoption, implementation, and use of IT innovations.

To account for the cause and effect of an innovation concept, we should examine the collective that generates and develops it. Each collective is a community of diverse organizations interested in an innovation; members of the community talk and write about the innovation. I theorize that concepts more prevalent or popular in this on-going conversation are more likely to prompt the adoption of underlying innovations. Then the crucial question is: *What makes an IT innovation concept popular?*

As an initial step to answer this question, I conducted an empirical study to examine the popularity of ERP (enterprise resource planning), arguably the most popular IT innovation concept in the past few decades. I hypothesize that the popularity of ERP was determined by the prevalence of the problems that ERP was purported to solve and by the popularity of innovation concepts related to ERP. The findings suggest that, first, the popularity of ERP, as measured by quarterly count of articles about ERP in publication outlets, was influenced positively by the prevalence of highlighted business problems that ERP was claimed to solve, but not by the problem ERP had originally been conceived to solve. Second, ERP's popularity was influenced negatively by the prevalence of innovation concepts closely related to ERP, but not by concepts distantly related or unrelated to ERP. Third, the influence of problem discourse and related older concepts disappeared after ERP passed its peak popularity, but the influence of related newer concepts remained. These results imply that the popularity of an IT innovation concept responds to the broader climate of business and relies on the

[1] Cited in (Kleiner, 2000, p. 30)
[2] Source: Bain & Company's 2005 management tools and trends survey, available www.bain.com/management_tools/home.asp, current January 20, 2006.

right type of attention drawn and released by other concepts within a network of concepts.

As its principal contribution, the paper enriches the theoretical view that social cognition drives the diffusion of IT innovations (Iacono and Kling, 2001; Rogers, 1995; Swanson and Ramiller, 1997). Essentially, I argue that an innovation concept emerges from social cognition and that the popularity of the concept is one channel through which social cognition drives the innovation's diffusion. To establish popularity as a distinctive construct in IT innovation research, my empirical investigation reveals some of the determinants of popularity. Both the theoretical arguments and the empirical findings demonstrate that IT innovation is not only an organizational endeavor but also a community undertaking beyond organizational boundaries. As such, when practitioners and researchers confront any new promising IT innovation, this research suggests that they evaluate an innovation concept's fit with the broader business environment and relationship with other popular concepts, as a way to make sense of the innovation and anticipate its impact on IT practice and research.

2. Theories

Central to the research on IT innovation is the question: Why do some information technologies come to be applied widely among organizations, while others do not? Employing and extending Rogers' (1995) seminal framework for the diffusion of innovations, IT scholars have studied information technologies as *organizational* innovations. Their research has converged to a dominant paradigm (Fichman, 2004). Under the paradigm, an IT innovation is defined as the organizational application of a new information technology (Swanson, 1994). Various organizational, technological, and environmental factors were found contributing to organizational IT adoptions. In a nutshell, "organizations that are larger, more diverse, have greater technical expertise, possess supportive senior management, operate in more competitive contexts, and perceive the innovation as more beneficial and compatible, are more likely to adopt a larger number of innovations, to adopt them earlier, and to implement them more thoroughly" (Fichman, 2004, p. 315).[3]

As models consistent with the paradigm have accomplished high predictability, Fichman (2004) suggested that the paradigm itself "may be reaching the point of diminishing returns" (p. 315) and identified several emerging research streams that do not presume the traditional assumptions of the dominant paradigm. In this spirit, I argue that the conventional focus on organization as *the* unit of analysis is too limiting, and IT innovation research should go beyond the organizational boundaries. I explain why next.

2.1. IT Innovations beyond Organizations

For adopters, it is clearly an *organizational* effort to implement the materials and processes associated with a new IT and assimilate them into work practices and routines. However, organizations increasingly rely on others in a broader environment to make sense of the IT and to formulate the adoption decision. Except for an IT's inventor, all organizations learn about the technology from outsiders such as competitors, suppliers, customers, consultants, the trade press, and universities. Further, as an increasing number of organizations choose to purchase or outsource IT products and services rather than develop their own in house (Lacity and Willcocks, 1998; Swanson, 2003), organizational decision makers are increasingly subject to external dynamics in a market for information (Zucker, 1991). Therefore, analysis confined within the boundary of each adopter organization is inadequate to account for the process of IT innovations.

In fact, a few innovation studies have examined a variety of actors and their activities outside the focal adopter organization, taking the economic-rationalistic, socio-relational, or socio-cognitive perspective (see Table 1 for a summary). Underlying the dominant paradigm Fichman (2004) described, the *economic-rationalistic* perspective focuses on the economic returns of IT innovations realized by organizations that rational decision makers run. From this perspective, the theory of network externalities explains why, for certain network technologies, the adoption decision depends on the number of other adopters (Brynjolfsson and Kemerer, 1996; Katz and Shapiro, 1986).

[3] See reviews on IT innovation research, e.g., Fichman, 2000; Gallivan, 2001; Swanson, 1994.

Informational cascade theory, further, suggests that, when their private assessments of an innovation go against the weight of observed adoptions by others, prospective adopters may discount their own assessments and follow others to adopt the innovation (Bikhchandani et al., 1992; Walden and Browne, 2002). This "herd behavior" may be optimal because, according to the theory of rational expectations, the crowd's average expected value of the innovation may approach the true value (Au and Kauffman, 2003). Common across these economic-rationalistic studies is the primary emphasis on other organizations that are also adopters of the innovations.

Social perspectives, on the other hand, are primarily concerned with the factors and processes in the social environment of the focal innovating organization. Studies from the *socio-relational* perspective have examined the implications of interorganizational relationships on innovations. For example, research on social contagion has shown that adoptions are more likely to be imitated when the adopters, often in a network of competitors, are perceived as more successful, prominent, and similar to the focal organization (Greve, 1995; Strang and Macy, 2001). Exploring a broader set of "other organizations," research on interorganizational IT has shown that adoption decisions are closely linked among organizations in the same value chain and that, in particular, power and trust among trading partners are important reasons for and consequences of innovations (Hart and Saunders, 1997; 1998). Moreover, taking an even broader view of social relations, innovation scholars have argued for "industrial infrastructures" for the innovations – networks of support and sponsorship by "other organizations" such as government agencies, research institutions, industry and professional associations (King et al., 1994; Lynn et al., 1996). For example, even though the Internet technology was invented in the 1960s, it had not been widely applied until the early 1990s when the United States government approved its use for commercial purposes (David, 2001).

While the competitive, transactional, collaborative, and regulative relationships provide important social structures for innovations, cognitive bases are also essential. That is, organizations must understand the innovations they adopt and use. The *socio-cognitive* perspective of innovation research views other organizations as important sources for that understanding. For example, government authorities, as part of the industrial infrastructure just mentioned, may go beyond their regulative roles to influence the belief systems of the adopter organizations through persuasion and propaganda (King et al., 1994). Organizing vision theory suggests that various organizations interested in an IT innovation form a community where they create and develop a vision, "for organizing in a way that embeds and utilizes information technology in organizational structures and processes" (Swanson and Ramiller, 1997, p. 460). Management fashion theory highlights the roles of "management knowledge entrepreneurs" – consulting, media, and research organizations that create and disseminate management knowledge – in shaping the wave-like collective attention paid to innovations (Abrahamson, 1996a; Abrahamson and Fairchild, 1999). Similarly, research from the *social construction of technology* and *social informatics* traditions has studied the organizations that frame the innovations in their design and use (Bijker, 1987; Iacono and Kling, 2001).

Taking all of this into account, I suggest that IT innovation research extend its focus from organizational analysis to other organizations. The economic-rationalistic view of the other organizations essentially stays within the dominant paradigm (Fichman, 2004). Empirical research from the socio-relational perspective has been steadily increasing (Strang and Soule, 1998). Much remains to be explored on how other organizations shape social cognition, which, in turn, shapes innovations (DeSanctis quoted in Swanson and Ramiller, 1997, p. 458). Embedded implicitly or explicitly in the studies from the socio-cognitive perspective is the idea that an innovation not only takes place in adopter organizations where it is materialized, but also exists in a *collective environment* where adopters, vendors, consultants, investors, journalists, analysts, academics, and others are interested in developing the innovation as a *concept*. In this sense, a broader, community level of analysis of IT innovations is more than a simple shift in the level of abstraction. While the *material* aspect of an innovation is always associated with particular organizations, it is the innovation *concept* that travels across organizational boundaries (Newell et al., 2000).

Table 1: Research on Organizations Other Than the Focal Organization Adopting Information Technology Innovations

Perspective	Theory/Concept	Representative Studies	Other Organizations Studied	Core Ideas
Economic-rationalistic	Network externalities	(Brynjolfsson and Kemerer, 1996; Katz and Shapiro, 1986)	Other adopting organizations in a technology network	For some technologies, the value of the technology to any particular adopter increases as the size of the network of other adopters grows.
	Informational cascade	(Bikhchandani et al., 1992; Walden and Browne, 2002)	Other adopting organizations	An organization adopts a technology based on the observed adoptions by others, overriding the organization's own evaluation of the technology.
	Rational expectations	(Au and Kauffman, 2003)	Other adopting or prospective adopting organizations	The true value of a technology corresponds to the average of organizations' expectations of the value of the technology.
Socio-relational	Social contagion	(Greve, 1995; Strang and Macy, 2001)	Other adopting organizations as competitors	An organization is more likely to imitate other organizations to adopt a new technology when they are perceived more prominent, successful, and similar to the focal organization.
	Power and trust	(Hart and Saunders, 1997; Hart and Saunders, 1998)	Other adopting organizations as trading partners	The adoption of an interorganizational IT can be obliged by trading partners with power and/or viewed as an opportunity to foster trust among trading partners.
	Regulation	(King et al., 1994; Lynn et al., 1996)	Mainly government authorities, but also international agencies, professional and industry associations, universities, etc.	Regulation is an institution's direct or indirect intervention in organizational innovations through sanction or other affirmative means.
Socio-cognitive	Influence	(King et al., 1994; Lynn et al., 1996)	Same as above	Influence is an institution's control over organizations' practices and beliefs about innovations via education, socialization, persuasion, and promotion.
	Organizing vision	(Currie, 2004; Swanson and Ramiller, 1997)	Prospective adopters, vendors, mass media, consultancies, scholars, etc.	An organizing vision is a focal community idea for the application of IT in organizations.
	Management fashion	(Abrahamson and Fairchild, 1999; Wang and Ramiller, 2004)	Management knowledge entrepreneurs: consultancies, mass media, research firms and institutions, etc.	A management fashion is a transitory collective belief, disseminated by the discourse of management-knowledge entrepreneurs, that an innovation is at the forefront of rational management progress.
	Technological frame	(Bijker, 1987; Davidson, 2002; Iacono and Kling, 2001)	Organizations that shape public discourse: government, research institutions, mass media, and professional associations	A technological frame provides simplified theories, goals, problem-solving strategies, and practices of use for a technology, enabling social actors' interactions.

2.2. IT Innovation Concept

Conceived in the community of organizations interested in an information technology, an IT innovation concept is a community *idea* about the development and utilization of the IT. For example, the customer relationship management (CRM) concept was created and developed by the CRM community. The once leading vendor Siebel Systems, despite its dominance in that community, never owned the concept; anyone interested in CRM can read, hear, write, and talk about the concept. Members of the CRM community may agree or disagree on certain aspects of the concept and, thus, promote or discredit the concept accordingly. In contrast, material elements of the CRM innovation (e.g., a CRM software package, a CRM implementation project, resources and processes involved in using CRM, and the data going into and coming out of a CRM system) often belong to particular organizations such as CRM vendors and adopters.

An innovation concept is similar to several notions in extant theories of social cognition. Specifically, as the product of social cognition, an innovation concept serves three functions in shaping the diffusion of the innovation. First, much as "technological frames" (Bijker, 1987) or "technological action frames" (Iacono and Kling, 2001) simplify and condense elements of complex technologies and their potential use, an IT innovation concept *theorizes* a new IT by abstracting various stakeholders' diverse interpretations of the technology into a potentially coherent meaning, which could help a large number of organizations comprehend and adopt the innovation. Second, besides meanings and interpretations, such theorization process also produces a quasi-theory that *legitimates* the innovation as an efficient solution to an important problem (Strang and Meyer, 1994). The strength of such theory and its effect on legitimating the innovation in part depend on and are signaled by the legitimacy of the actors contributing to the theory. Third, each innovation concept often carries an "organizing vision" for embedding and utilizing an IT in organizational structures and processes (Swanson and Ramiller, 1997). In this way, the innovation concept *mobilizes* material resources to realize the innovation.

In shaping the diffusion of IT innovations, innovation concepts serve the above three functions (theorization, legitimation, and mobilization) through community members' ongoing conversation, or *discourse*, about the innovations. Discourse carries community members' ideas, opinions, and beliefs underlying each concept. There are numerous discourse outlets in each community including advertisements, books, magazine articles, conference and exposition speeches, training materials, brochures, interview scripts, roundtable discussions, blogs, and so on. Discourse outlets serve as the developmental tools for community members to advance and promulgate the concept. Although for decades industry pundits and consultants have been engaging discourse to promote various innovation concepts in order to accelerate adoption, only recently has innovation research underscored the important role of discourse in enabling widespread diffusion of innovations (Abrahamson, 1991; Green, 2004; Swanson and Ramiller, 1997; 2004).

Students of discourse examine mainly two properties of discourse: the content and volume (Phillips and Hardy, 2002). In the former stream, innovation scholars have usefully investigated how actors strategically employ language to manipulate the content of discourse in order to advocate or oppose the adoption of innovations (e.g., Suddaby and Greenwood, 2005). In the latter stream, researchers have recorded the volume of discourse on particular innovation concepts in order to trace changes in the popularity of those concepts and then relate the changes to the diffusion of innovations (e.g., Abrahamson and Fairchild, 1999). A third research strategy has been to examine both content and volume, making it possible to understand the contexts in which volume patterns emerge and evolve and contents originate and shift in a discourse community. Although this study is primarily focused on the *popularity* of innovation concepts and its determinants in terms of the dynamic volume of discourse, as we will see, analysis of the contents (especially the sentiments expressed in the discourse) helps us understand the relationship between concept popularity and the adoptions of innovations.

2.3. Popularity of IT Innovation Concept

I define the popularity of an IT innovation concept as the *prevalence of the concept in public*

discourse.[4] Once a concept is created, if the volume of discourse carrying the concept increases, the concept becomes more visible or prevalent, ascending in popularity. On the other hand, when discourse about the concept decreases, its popularity declines. The past several decades have seen many IT innovation concepts undergo wide swings in popularity.[5] The popularity of innovation concept has the potential to become an important construct in innovation research, because *innovations are more likely to be adopted in practice if their associated concepts are more popular in the discourse*, for the following theoretical reasons.

Foremost, it is well documented that today's managers suffer from *information overload*, that is, they receive information in excess of their available attention (Simon, 1971). Nonetheless, managers are constantly on the lookout for important new IT that they hope will bring benefits to their organizations. Innovation concepts more prevalent in the discourse are more likely to capture scarce managerial attention, thus increasing the likelihood of adoption. For example, "While on a business flight, a CEO reads in an airline magazine about an information technology innovation that promises fabulous returns to the adopting corporation. Returning home, the CEO demands immediate *action* from the senior information systems executive" (Ramiller, 2001, p. 287, emphasis added). While Ramiller analyzed the causes and implications of this problematic but often seen "airline magazine syndrome," the innovation concept had to be popular enough to be reported in the airline magazine to begin with. In short, popularity helps bring an innovation onto managers' "radar screens."

However, managers do not necessarily take action on everything that comes to their attention. In addition to the attention it helps attract, the popularity of an innovation concept brings out a host of meanings that increase the likelihood of adoption. On the one hand, popular innovations are often perceived as cutting-edge technologies advancing at the "forefront" of progress (Abrahamson, 1996a). In most cultures where *norms of progress* mandate that managers use state-of-the-art technologies to manage and operate their organizations (Granovetter, 1979), the popularity of an innovation concept renders legitimacy to those adopting the innovation. For instance, Staw and Epstein (2000) found that, when the total quality management (TQM) concept was very popular in the late 1980s to the mid 1990s, companies that adopted TQM had higher legitimacy (measured by corporate reputation and executive compensation) than did those without TQM programs. Hence, managers intuiting the positive relationship between popularity and legitimacy will adopt popular innovations to signal to other organizational stakeholders (e.g., stockholders, regulators, suppliers, and customers) that they conform to the mandate of progress, thus maintaining or enhancing their own and their organizations' reputation (Meyer and Rowan, 1977).

On the other hand, it has been recently argued that the popularity of an innovation concept may be understood as an indicator of *perceived* utility of the underlying technology (Czarniawska and Sevón, 1996). Following this argument, innovation concepts more prevalent in the discourse are simply *perceived* to be more efficient and useful and, thus, rational, performance-driven managers adopt them. It is important to note the emphasis on the word "perceived" in the previous two sentences, since the popularity of an innovation concept does not necessarily correspond to the utility of the innovation *measured objectively*. As a matter of fact, Staw and Epstein (2000) found that organizations associated with popular management techniques did not have higher economic performance. Nevertheless, the illusionary link between popularity and perceived utility will occur whenever uncertainty and ambiguity surround the assessment of an innovation's utility (Abrahamson, 1996b), a not uncommon situation where new IT is concerned. Under uncertainty and ambiguity, managers find themselves relying on unambiguous signals, such as concept popularity, as indicators

[4] According to the Merriam-Webster Dictionary, the word "popularity" has at least two meanings. One refers to the quality of being commonly liked or found pleasant or praiseworthy; the other refers to the state of being frequently encountered, prevalent, or visible. I use the term in the latter sense only (Kabanoff and Abrahamson, 1997).

[5] The wave-like popularity cycles may correspond to the lifecycles of management fashions (Abrahamson and Fairchild, 1999). As noted earlier, management fashion theory addresses the social-cognitive aspect of innovations, an area this study also contributes to. However, the definition of popularity here does not assume a fashion-like cycle, making it possible to study popularity contemporarily, in addition to historical treatments in management fashion research.

of others' assessment of the innovation to infer the utility of the underlying innovation (Bikhchandani et al., 1992). While the "wisdom of crowds" may be true in some cases but not in others (Surowiecki, 2005), utility inferred from popularity has been found in empirical research. For example, Gallaugher and Wang (2002) found that firms were willing to not only adopt Web server software products mentioned more frequently in the trade press (i.e., with a larger "mindshare") but also pay more for these popular products (controlling for factors such as existing market share, cross-market complementarities, standards, and trialability). Further, quite a few IT innovations whose associated concepts had been very popular became institutionalized in numerous organizations as useful and indispensable components of organizational information systems (Fichman, 2004). This *ex post* observation may prompt managers to expect current popular innovations to have the same favorable future course (Rosenberg, 1976) or destiny (Fichman, 2003), and this expectation may sway their decisions in favor of adoption when *any* innovation concept becomes popular.

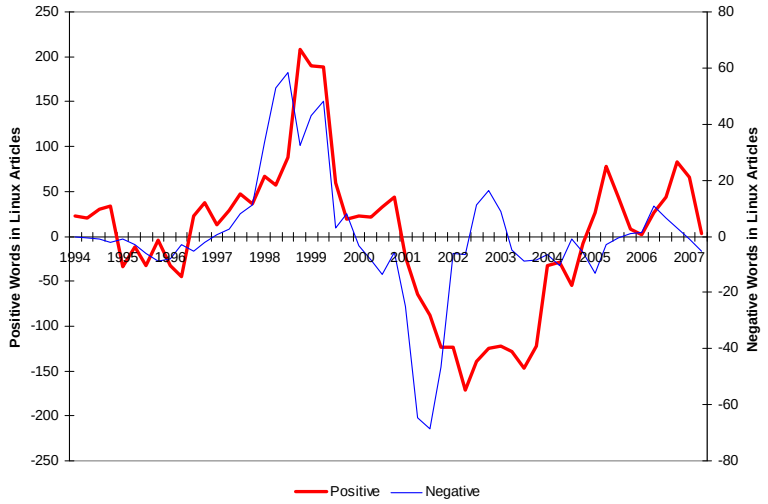
Summarizing these theoretical reasons, I argue that the prevalence of an IT innovation concept in the discourse, or its popularity, positively influences the adoption of the underlying material innovation by (1) attracting managerial attention, (2) representing the latest mandate of progress, (3) indicating perceived utility of the innovation, and (4) suggesting a favorable future of the technology. My argument, however, is subject to at least two important qualifications.

The more obvious qualification is that the positive link between concept popularity and innovation adoptions is more likely to appear in the early to mid phases of an innovation's lifecycle than in the late phase. For an innovation that has been proven to be ineffective, its late phase would see dwindling discourse go hand-in-hand with dwindling adoptions, hence, there would still be a positive correlation between concept popularity and innovation adoptions. On the other hand, innovations that become institutionalized would experience an increasing or stable adoption base and, at the same time, decreasing prevalence in the discourse (because there is nothing more to say or write about them), hence, there would be a less positive, or even a negative correlation between concept popularity and innovation adoptions (Green, 2004).

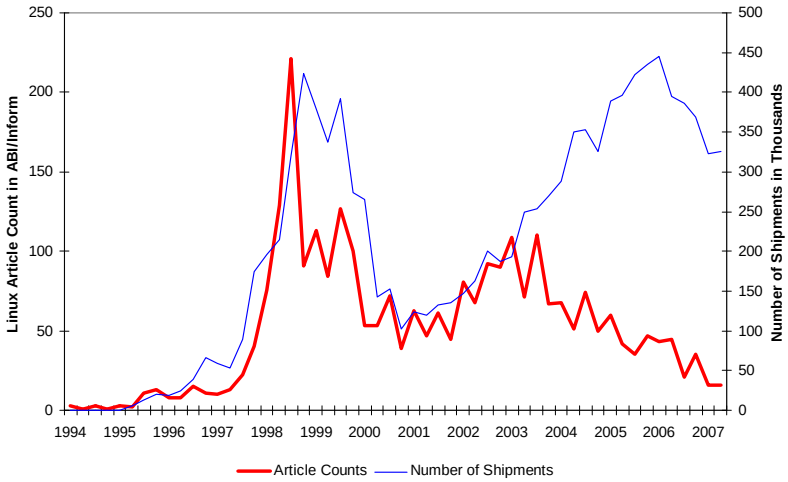
The other qualification speaks to the relationship among the adoptions of an innovation, its prevalence in the discourse, and the sentiments expressed in the innovation's discourse. In a case study of the management innovation Quality Circles (QC), Abrahamson and Fairchild (1999) found that positive and emotionally charged language characterizes the rise of QC in discourse and practice, whereas reasoned and negative sentiments characterize QC's decline. Based on this finding, the authors suspected that knowledge entrepreneurs (e.g., gurus, consultants, journalists, and scholars), motivated by extraordinary gains associated with popular innovations and facing severe competition in the knowledge marketplace, deliberately exaggerate the benefits of certain new technologies and use unusually positive language to promote the innovations to prospective adopters. Then, when such innovations fail to meet the expectations for whatever reason, these entrepreneurs debunk them with negative language. The success of this strategy, however, depends in part on the gullibility of the managers at prospective adopter organizations (Abrahamson, 1996b), and on the strength of the defense played by the stakeholders of existing technologies.

When the contest between the old and new is acute, positive sentiments may not always characterize the rise of an innovation's discourse or adoptions. As a matter of fact, whether its discourse and adoptions will rise, in the case of a controversial innovation, becomes an open question.[6] In the world of IT, an example of such controversial innovations is open source software (OSS). In contrast to proprietary software, OSS is often developed in a public and collaborative manner and its source code is available for reuse, modification, and redistribution. Among the numerous OSS projects, Linux is one of the earliest and most prominent. Since Linus Torvalds invented this Unix-like computer operating system in 1991, Linux has been a controversial topic at the center of the debate over OSS and proprietary software. Employing the same methods Abrahamson and Fairchild (1999) used, I conducted a similar analysis on Linux. The upper panel of Figure 1 shows that both positive and negative sentiments were salient in the early to mid phases of Linux' diffusion. Further, the lower

[6] I thank a reviewer and the Senior Editor for suggesting this point.



The raw data are the abstracts of articles whose titles, abstracts, or subjects contain Linux in the ABI/Inform Global database from 1994 to 2007. The abstracts are scanned by the content analysis software *General Inquirer*, which classifies words into discrete semantic categories: positive and negative. Following Abrahamson and Fairchild's (1999) approach, I counted the total number of words in the Linux article abstracts in each year t denoted by X_t, as well as the yearly total number of words in each semantic category, c = 1 or 2, denoted by $Y_{tc\ actual}$. I regressed $Y_{tc\ actual}$ on X_t to obtain regression coefficient β_c. Then I calculated a prediction, $Y_{tc\ predicted}$, of the number of words in the category c given the total number of words that year X_t using the equation: $Y_{tc\ predicted} = \beta_c * X_t$. Further, I calculated $Y_{residual} = Y_{tc\ actual} - Y_{tc\ predicted}$, which is the yearly deviation in the number of words in each category from the number of words in that category that would have been predicted given the total number of words in the abstracts that year. A negative value of $Y_{residual}$ in the "positive" category for Year t, for example, indicates that there were fewer positive words than expected in that year, so that the discourse was not particularly positive that year when compared with all other years. In contrast, a positive value of $Y_{residual}$ in the "positive" category for Year t indicates that the discourse was particularly positive that year when compared with all other years.



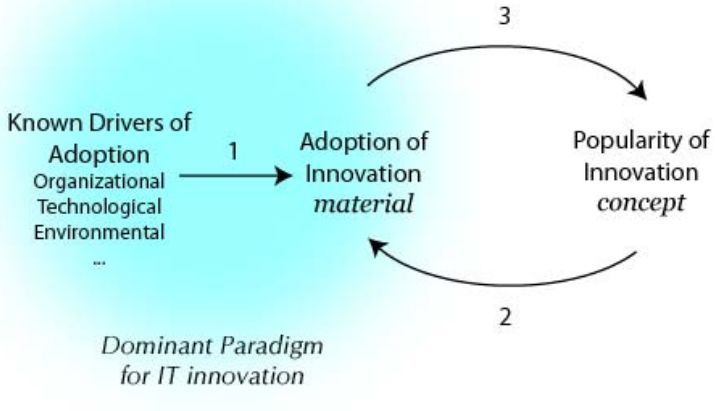
Article counts are the numbers of the same articles used in the above sentiment analysis. The shipment data show the quarterly numbers of Linux shipments for server operating systems, reported in *IDC Quarterly Server Tracker*.

Figure 1. Linux Sentiments, Article Counts, and Adoptions

panel of Figure 1 shows that, despite the controversy around Linux, the rise of Linux discourse concurred with the increasing adoptions of Linux (as measured by quarterly Linux shipments) with a correlation of .93 (before the discourse peak). These findings suggest that the presence of negative

coverage of Linux did not prevent the positive link between Linux discourse and adoptions from occurring, indicating a "no news is bad news" logic. Nonetheless, it must be acknowledged that when the negative coverage of an innovation surpasses a certain threshold, the link between prevalence to adoptions may collapse. In other words, when most people say or write that an innovation is a bad idea, the innovation's prevalence in the discourse may still increase, but the debunking discourse may not be translated into adoptions. Therefore, the causal relationship between concept popularity and adoptions depends on *the level of controversy* associated with the focal innovation. A positive relationship may hold even with a relatively high level of controversy (such as in the Linux case).

With these qualifications in mind, I contend that IT innovation research may benefit from studying the popularity of an innovation concept as a promising new construct. As Figure 2 shows, studies in the dominant paradigm for IT innovation research have traditionally investigated how organizational, technological, and environmental factors influence individual organizations' supposedly independent and rational choices of material innovations (as indicated by Arrow 1). Complementary to the paradigm, the notion of the IT innovation concept suggests that adoption decisions, however independently and rationally made on the organizational plane, are also situated (and thus can be better understood) in a broader, interorganizational community where interested actors create and develop a grand concept for organizing an IT innovation in organizations. Specifically, popularity of the innovation concept aids the adoption of the material innovation (Arrow 2). As shown in Gallaugher and Wang's (2002) study mentioned previously, both the factors traditionally investigated and popularity (which the authors called "mentions in the media" or "mind share") had a significant impact on the adoptions and pricing of Web server software. However, because the susceptibility to external discourse may differ across organizations and change over time, the relative significance of the popularity effect, in comparison to that of other adoption drivers, may vary. For example, in "mindful" organizations where they attach much importance to their own organizational specifics (Swanson and Ramiller, 2004), the effect of popularity on adoption decision-making may not be vital. As an innovation concept rapidly rises to its peak ascension, the effect of popularity on adoption may become stronger, especially among the so-called "mindless" organizations or those who outsource their adoption reasoning, both relatively more susceptible to external discourse.



Numeric labels do not represent temporal sequencing.

Figure 2. Information Technology Innovation Concept vs. Material Innovation

Further, the relationship between popularity and adoption should be understood as reciprocal because, as more organizations adopt the innovation, more community members are interested in talking, writing, hearing, and reading about the innovation concept, boosting its popularity (Arrow 3). Especially when organizations with high status undertake an innovation, these

high-profile adoptions will literally elicit a high profile – a high level of public exposure – for the innovation, raising its perceived legitimacy and utility (Wang and Swanson, 2007). Although it is interesting to tease out the construct of popularity, the theoretical value of the construct in understanding innovation diffusion would be limited if popularity were entirely induced from adoption. *What other factors might drive popularity*? The answer to this question will eventually establish the popularity construct's own legitimacy in IT innovation research, as opposed to its perception as a synonym of adoption in a tautological argument. Accordingly, my empirical investigation seeks to answer the research question: What, besides adoption, makes an IT innovation concept popular?

2.4. Hypothesis Development

Popularity is a property of an innovation concept, which belongs to the community where the concept is created and sustained. One challenge in exploring the determinants of popularity is that the community, *as a whole*, does not plan, coordinate, or take any action to directly boost or suppress the popularity of any concept and, thus, researchers cannot explain popularity simply by studying the characteristics of the community. In fact, the members of an innovation community discuss the innovation concept in various discourse outlets in largely free ways; hence, attempts to explain popularity in the aggregate (i.e., a community's total volume of discourse on an innovation concept) miss the very opportunity to understand the pertinent context where community members select one concept to discuss over another, and, thus, lead their popularity to rise or fall.

However, it is another challenge to track down the individual and organizational members of an innovation community and theorize how their traits and actions influence the popularity of the innovation concept in the discourse. Notwithstanding the obvious observation difficulty, stories of particular organizational and behavioral details that lead to an increased likelihood of discussing certain concepts defy theoretical prediction. The problem is that the diverse and dynamic membership of an innovation community makes it difficult to consistently predict what traits or actions matter, to what extent, and when they matter. This approach would neglect the fact that diverse members belong to the same community and, by interacting with each other, they come to develop, to varying degrees, similar appreciations and common sensitivities for innovation concepts. Blumer (1969) argued that it is these similar appreciations and common sensitivities that sharpen and direct diverse actors' "feelings of discrimination," which further channel their seemingly independent judgments and autonomous choices that turn out to be largely the same.

One way to meet both challenges mentioned above is to focus on the prevalence of an innovation concept in each *outlet* of *published* discourse. On the one hand, published discourse outlets in democratic societies, whether they are trade press, popular press, or academic journals, independently select what topics to cover and how to cover them. Such autonomous practices mimic the processes by which members choose to participate in the community discourse. On the other hand, it is, in fact, these outlets' business to represent what community members say and write about an innovation. Publication outlets, through interactions with their readers, contributors, advertisers, and peers, can and do sense similar appreciation and common sensitivities for specific topics. More often in alignment with the dominant topical trends across innovation communities than not, publication outlets serve as unwitting agents (Blumer, 1969) or careful gatekeepers (Allen, 1977) of the public in selecting concepts to pay attention to. Therefore, in order to explain the popularity of any innovation concept, the researcher may examine the prevalence of the concept in published discourse outlets and investigate the similar appreciation and common sensitivities that underlie popularity.

An apparent source for similar appreciation and common sensitivities is the practice of business and management, from which publication outlets and their contributors draw ideas and to which they build relevant discourse. One enduring emphasis in business and management is organizational performance (March and Sutton, 1997). On the one hand, managers routinely set targets for performance in finance, operation, marketing, customer services, employee relations, and the like. When gaps exist between the targets and the performance actually achieved, managers are motivated to find the problems causing the performance gaps and to search for innovative solutions

to the problems, therefore narrowing the gaps (March and Simon, 1958). At any given time in an organization, there may be a number of performance gaps caused by numerous problems. Given the limited amount of managerial attention, those few problems and performance gaps that discourse highlights and brings to the top of managers' agendas can prompt managers to search for possible solutions (Hilgartner and Bosk, 1988). On the other hand, numerous administrative and technological innovations emerge and exist for improving business and management performance. Many of these innovations are solutions in search of problems (Cohen et al., 1972). One innovation may be purported as the solution to different problems at different points of time. For example, CRM was initially promoted as an automation tool for improving the efficiency of an organization's sales forces, then as a backbone technology for enhancing the effectiveness of customer services, and now as a marketing innovation for market intelligence gathering (Wang and Swanson, 2008). Taken together, for an innovation concept to gain in relevance and appeal, the concept must be linked to a current problem or performance gap widely recognized in the practice of business and management (Swanson and Ramiller, 1997). Once an innovation concept is linked to a business problem, the pervasiveness of the problem can then be hypothesized to shape managers' collective appreciation for its solution, and thus, the likelihood that the innovation concept appears in a discourse outlet. Empirical studies of management innovations have found evidence in support of this hypothesis. For example, the fluctuation of reported labor union activities was positively associated with the popularity of systematic management between 1879 and 1932 (Shenhav, 1995). Similarly, Abrahamson (1997) found that recorded voluntary turnover was positively associated with the prevalence of human relations/personnel management discourse between 1875 and 1992. In this study, I test this hypothesis in the context of IT innovations.[7]

> **Hypothesis 1.** *The prevalence of a business problem in discourse is positively associated with the volume of the discourse purporting an IT innovation as the solution in a discourse outlet*.

Concepts rarely arise in isolation. In the IT academic research community, Lyytinen and King (2004) observed that dynamic and diverse research subcommittees compete and coalesce around "markets of ideas." Likewise, in the practical reality of innovating with IT, organizations and their decision makers are in the market for innovation concepts. Swanson and Ramiller (1997) argued that innovation concepts belong to various problem domains. In each domain, similar concepts addressing similar problems may overlap, blend, or clash with each other. To understand the ecology of innovation concepts in a problem domain, consider the notion of *niche*. In the ecological context, "the niche of an animal means its place in the biotic environment, its relations to food and enemies" (Elton, 1927). One species occupies one niche. Species of larger size occupy larger niches. If two species are consuming the same sources of food at the same time and place in the same stable community, as each niche has a finite amount of resources, one of the species will have the advantage and the other will become extinct. In short, complete competitors cannot coexist in the same niche. This phenomenon is called the principle of competitive exclusion (Gause, 1934).

By the same token, each innovation concept can be likened to a species competing with other concepts for resources. What kind of resources does a concept consume? Just like an arctic fox subsisting upon guillemot eggs and the remains of seals killed by polar bears, an innovation concept consumes ***attention*** from the member organizations and their people in the community. Lions die if they eat grass only. Certain concepts require certain *types* of attention. For example, the concept of computer-aided software engineering (CASE) asks for attention mainly from system analysts and programmers. Their attention may also be "nutritious" to the object-oriented programming (OOP) concept, but not so much to CRM, which thrives on the attention from a different group of people. Because CASE and OOP "consume" the same type of attention (i.e., from the same group of people), the two concepts are related. Innovation concepts can be related for other reasons. They may be

[7] Although a business problem or performance gap is driven by forces largely outside the community of a managerial or technological solution (Abrahamson and Fairchild, 1999; Swanson and Ramiller, 1997), it should be noted that breakthroughs often pose "technology push" (Mowery and Rosenberg, 1979) that makes certain problems solvable and thus recognizable. However, this study assumes that it is essentially the *capability* of a new technology, rather than its popularity, that solves a problem and triggers the awareness of the problem.

developed to solve similar problems; require common knowledge for understanding the problems or similar skills to implement the solutions; and/or share the practices, functions, or roles to be affected by the innovations. To the extent two innovation concepts are related, attention may flow from one to the other. Therefore, the discourses on related concepts relying on the same type of attention should be correlated (negatively) in terms of their popularity, while discourses for unrelated concepts not relying on the same type of attention should not be correlated. Studying the prevalence of four consecutive employee-management innovations in discourse, Abrahamson and Fairchild (1999) found a consistent tendency for the sharp downswing in the volume of an innovation discourse to antedate the sharp upswing in the next innovation discourse. They interpreted from this result that, in the employee-management innovation niche, the decline of an old innovation's popularity triggers the rising popularity of the next innovation. In terms of attention flow, decreasing discourse for a concept releases the attention needed for a related concept to rise. This leads to the second hypothesis.

> **Hypothesis 2.** *The prevalence of an innovation concept in discourse is negatively associated with the volume of the discourse on a related concept in a discourse outlet.*

3. Methods

To test the hypotheses, I have chosen to examine one IT innovation concept as an initial step to understand the making of popularity. If support is found, tests using discourses on other concepts should be in order. The copiousness of innovation concepts in IT poses a challenge: which concept to study? Following Benbasat and Zmud's (1999) suggestion to increase the relevance of IT research, the concept to be studied should be relatively current and represent an innovation with significant market size. Additionally, its popularity should have gone through the full ascendant phase and part of the descendant phase so that there is sufficient variance to be explained by the factors identified above. These criteria eliminated concepts such as material requirements planning (MRP), since it is relatively old, data administration, since its scope is relatively limited, and cloud computing, since it is quite new. ERP, in contrast, meets the above criteria. In addition, ERP was arguably the most popular IT innovation in the 1990s (Robey et al., 2002) and potentially even the 20th century (Wagner and Newell, 2006). Further, since its origination, the term ERP has consistently focused on the domain of organizational IT applications, as opposed to the Internet and e-commerce, whose use has become quite general and diffuse. Fore these reasons, I study the popularity of ERP.

3.1. The ERP Concept

ERP represents a class of enterprise software that integrates an organization's diverse business functions into one system. The heart of an ERP system is a central database that collects data from and feeds data into all the ERP system's individual application components, called modules. These modules support diverse business functions such as finance, manufacturing, logistics, and human resources. When new information is entered or updated in one module, other related modules in the system are automatically updated.

Although enterprisewide systems have been in existence for decades, it was in April 1990 when Gartner Group introduced the ERP concept as the next-generation of MRP II (manufacturing resource planning) in response to many large manufacturing companies' dissatisfaction with their MRP II systems (Keller, 1999). In 1992, market leader SAP introduced a client-server-based ERP package that quickly conquered the European and U.S. markets. Major ERP vendors (SAP, Oracle, PeopleSoft, Baan, and J. D. Edwards) enjoyed dramatic growth in the mid and late 1990s. By the end of 1998, more than 60 percent of the Fortune 1000 companies had implemented ERP core applications (Stein, 1999). With expanding functionalities and new interfaces added, ERP packages quickly spread from large companies to midsize companies, from European and U.S. markets to Asia Pacific and Latin America, from manufacturing and logistics companies to other vertical industries such as wholesale, healthcare, and banking. Since 2000, the adoption rates for ERP solutions have suggested a market in decline. Nonetheless, an increasing number of organizations have earmarked budgets to enhance their existing ERP systems.[8] Further, web-enabled applications have opened

[8] IDC, "Enterprise resource management market penetration and adoption strategy" by Tom Gilmore and Lucie

new market opportunities for ERP.

3.2. Data

Among the discourse outlets for ERP, this study focuses on archived published discourse as the primary data source, mainly because archived publications offer the most reliable and systematic records of the discourse. They are free from the recollection bias commonly seen in interviews and technical difficulties often occurring in observations. Specifically, I counted articles under specific subjects in the ABI/Inform Global database (hereafter, ABI). ABI has provided indexing for more than 1,800 outlets or periodicals since 1971. Representing a wide variety of business-related disciplines and industries, these periodicals include academic journals (e.g., *MIS Quarterly*), industry-specific magazines (e.g., *Chemical Week*), trade press (e.g., *InformationWeek*), and popular press (e.g., *Fortune*).

The first article on ERP appeared in ABI in October 1991 (Baer, 1991). The overall volume of ERP articles increased until 1999 and began decreasing in 2000, suggesting that a 45-quarter window (Q4 1991- Q4 2002) would be sufficient to map the popularity of the ERP concept. Since the popularity of an innovation concept helps attract managerial attention conducive for adoption, as I reasoned previously, I counted articles that feature ERP as a main subject, because they are more likely to catch readers' attention than those mentioning it only in passing. In 1997, considering the large volume of articles focusing on ERP, ABI created a unique subject heading "enterprise resource planning" for ABI content analysts to categorize articles discussing ERP as a main subject.[9] To measure the volume of ERP discourse in each outlet, the dependent variable of the empirical study, I searched in the titles and abstracts of all articles in ABI for the phrase "enterprise resource planning" *for each periodical* in each quarter[10] from 1991 to 1996 and found 125 articles. Then I asked two raters, who did not know the purpose of this study, to independently read the abstracts of the articles and put them in two categories: articles discussing ERP as a main subject and articles mentioning ERP in passing. The inter-rater reliability of the classification was 96 percent. For further analysis, I then retained 94 that both raters considered to be articles about ERP from 1991-96. Next, I counted articles listed under the ERP subject heading *for each periodical* in each quarter from 1997 to 2002.

Hypothesis 1 is concerned with the prevalence of business problems in discourse. In its nearly two-decade evolution, ERP has been argued to solve a number of problems for organizations in many industries (O'Leary, 2000). The origins of such rationales differ and their own popularities vary over time. In this research, I study four problems to illustrate the impact of problem discourse on the popularity of ERP and the methods to examine such impact. First, one of the problems that ERP systems were originally claimed to solve is the fragmentation of information in large business organizations (Davenport, 1998). To see how much this problem was highlighted in the discourse, I counted articles in ABI about the information fragmentation problem. Specifically, for lack of a distinctive term, I first searched for articles under the subjects of both "information management" and "problems." The search returned 319 articles published between 1991 and 2002 discussing various problems with information management. Second, to figure out which articles addressed information fragmentation specifically, I randomly selected 33 from the 319 articles and read their abstracts. I found five articles about information fragmentation. Based on my reading of the full-text of these five articles, I then compiled a list of keywords frequently used in discussing information fragmentation: technological silos, organizational silos, redundancy, error, delay, access difficulty, and inconsistency. Next, the two raters read the abstracts of the 319 articles found in the first step using the keywords for information fragmentation. They independently selected the articles that mentioned at least one of the codes in the abstracts. The inter-rater reliability was 93 percent. In total, there were 69 articles that both raters considered addressed information fragmentation. Finally, I classified the 69 articles by quarter based on their publication dates. In this way, I obtained data for the first independent

Draper, Document #24884, June 2001.

[9] ABI analysts use the ERP label to classify all articles about ERP, including those using alternative terms such "Enterprise System" or "Enterprise Information System."

[10] In the dataset, every periodical published at least one issue each quarter, so there was no obvious reason to aggregate the data into semiannual or annual data.

variable, namely the number of articles about the information fragmentation problem published in ABI each quarter. Unlike the dependent variable, which measures the volume of ERP discourse at each periodical level, this independent variable aggregates article counts across periodicals each quarter. In fact, all independent variables are aggregate counts based on the assumption that the community members' common sensitivities and similar appreciation for broader issues such as information fragmentation are more of community phenomena than are the properties of any particular periodical.

Second, it has also been argued that ERP systems enable organizations to streamline operations, reducing operational inefficiency (Davenport, 1998; Wagle, 1998). Thus, I examine how the discourse about operational inefficiency is related to the popularity of ERP. Similar to information fragmentation, operational inefficiency may manifest itself in many forms and, accordingly, can be discussed with diverse terms. To measure the volume of discourse on operational inefficiency, I employed the same method I used for information fragmentation. I first search articles with the subjects "operations management" and "problems" in ABI. Then I developed a list of keywords for operational inefficiency in managing facilities, procurement, production (including planning, control, quality, inventory, and safety), maintenance, and research and development. Reading of article abstracts turned up 78 articles published between 1991 and 2002 that were selected by both raters as related to operational inefficiency. I classified them by quarter, and the second independent variable was established.

Third, the Year 2000 (Y2K) conversion issue was brought to managers' attention in the mid-1990s. To conserve computer memory and storage space and thus reduce the high cost of computing, programmers in the 1950s and 1960s used two, rather than four, digits to represent year. This practice became a programming convention, but it became clear later that software programmed this way would confuse years after 1999 with those a century ago. Worried that their legacy systems might break down when Year 2000 arrived, many companies found it more economical to completely replace their legacy systems with Y2K-compliant ERP systems (Minahan, 1998). To investigate the influence of this problem on the popularity of the ERP concept, I counted articles on Y2K, by searching the unique term Y2K or Year 2000 in the subjects and, when subjects were not available, in the titles and abstracts of articles. Along with the Y2K problem, the difficulty of maintaining inefficient and deficient legacy systems was brought to light. ERP was proposed and adopted to replace the legacy systems whether or not Y2K was the primary issue. Therefore, I counted articles on legacy systems, by searching the unique term "legacy systems" in the subjects, or titles or abstracts (when subjects were not available). In similar ways, I constructed the third and fourth independent variables (Y2K and legacy systems, respectively).

Hypothesis 2 is about the relationship between an innovation concept and a *related* new concept. Among the several dimensions that define ERP's relation with other concepts, the problems ERP addresses have continuously evolved. ERP systems grew out of the older manufacturing-planning software – MRP II. ERP markedly expanded functionalities from those of MRP II. ERP software offerings also have been extended to include new functionalities such as business intelligence (BI), data warehousing, and advanced planning and scheduling (APS). Consequently, it is difficult to draw a boundary and give a label to a clearly delineated domain or niche, where ERP and other concepts are related. To overcome this difficulty, first, I counted articles on MRP II, the precursor of ERP. Second, I counted articles on another innovation – business process reengineering (BPR), which has been argued to be closely related to ERP.[11] Third, I counted articles on two relatively newer innovations – CRM and SCM (supply chain management), because ERP, CRM, and SCM have been increasingly considered as related applications of an organization's "Enterprise Systems" (Hendricks et al., 2007). Last, I counted articles on innovations such as EDI, decision support systems (DSS), and TQM, which may or may not be related to ERP. Strictly speaking, TQM and BPR are management innovations. However, as both involve the use of IT, attention to TQM and BPR may have flowed to IT concepts such as ERP. As illustrations, these seven innovations fall in a good range of relatedness to ERP.

[11] For BPR, new business processes call for new information systems. Moreover, ERP later became the means to reengineer business processes for many companies.

Except for the topics of information fragmentation and operational inefficiency, which never had unique subjects in ABI, I used the same search strategy to count articles on all other nine topics (i.e., the dependent variable and eight independent variables). That is, when a unique subject was provided by ABI, I searched under that subject heading; when the subject was not available, I searched in article titles and abstracts and then eliminated irrelevant articles based on the two raters' consensus. The content validity of this strategy and the factors measured this way can be assured in three parts. First, ABI's assignment of articles to subjects is "accomplished and checked by trained and experienced content analysts, working in industry- and function-specific teams" (Abrahamson and Fairchild, 1999, p. 717). Second, the number of articles that had appeared in ABI before a unique subject was created typically was not very large and, thus, selecting relevant articles from the title/abstract search results was so straightforward that the inter-rater reliability scores ranged from 93 percent to 100 percent. Third, for each of the nine topics, I randomly selected three quarters when the unique subject heading was available in ABI. I downloaded the abstracts of all articles whose titles and abstracts contained the topic. Then the two raters read the abstracts and independently selected articles where the topic was a subject. For all 27 quarters (9 topics X 3 quarters/topic), the inter-rater reliability was 85 percent. Then I counted the articles selected by both raters. Across the 27 quarters, the correlation between the counts based on the title/abstract analysis and counts based on subject searches was .87. Therefore, these efforts provided reasonable confidence that the volume measures in quarters without a unique subject were consistent with volume measures in quarters with the subject.

3.3. Data Analysis

Table 2 summarizes the operational definitions of all variables. The dependent variable is ERP article count y_{jq} for each periodical j in each quarter q in the study period (Q4 1991-Q4 2002). The rate at which each periodical publishes articles on ERP is hypothesized to be influenced by two factors: the volumes of problem discourse and discourses on other concepts. The notation x_{kjq} represents the kth independent variable for periodical j in quarter q.

As previously mentioned, the ERP concept's popularity may have also come from the adoption of the material innovation. To control for adoption-induced popularity, I included the annual worldwide ERP software revenue as a control variable (in log form to reduce non-linearity). To partial out the effect of periodical-specific factors on the outcome, I included four more control variables: each periodical's age, authorship and readership (academic/non-academic), frequency, and headquarters' location (U.S.-/non-U.S.-based). To exclude the potential influence of time, a linear time trend (updated each quarter) was also included as a control variable. These control variables are denoted similarly as x_{kjq} for the kth variable for periodical j in quarter q.

To infer causality, the dependent variable lagged one quarter behind all independent and control variables because every periodical in ABI publishes at least one issue per quarter, and it is reasonable and conservative to assume that topical decisions are made and updated at least once a quarter. Since the dependent variable is article count, I used count data regression (i.e., negative binomial regression).[12] In sum, the expected number of articles on ERP published by each periodical in each quarter can be modeled as a function of two factors and control variables:

$$\mu_{jq} = \exp [\beta_0 + \beta_1 x_{1j(q-1)} + \beta_2 x_{2j(q-1)} + \ldots + \beta_m x_{mj(q-1)}]$$

where μ_{jq} is the expected value of y_{jq} (i.e., $\mu_{jq} = E[y_{jq} | x_{1j(q-1)}, x_{2j(q-1)}, \ldots, x_{mj(q-1)}]$) and β's are parameters to be estimated.

[12] The most commonly used count models are Poisson and negative binomial. Poisson is the special case of negative binomial when the conditional variance equals the conditional mean. In this study, the variance of the dependent variable far exceeds its mean (i.e., the data are over-dispersed) as shown in Table 2, so negative binomial is more appropriate than Poisson.

Table 2: Operational Definitions and Descriptive Statistics of Variables

	Variable Label	Operational Definition	Mean	St. Dev.
Dependent Variable				
1	ERP	ERP article count per periodical per quarter	0.81	2.72
Control Variable				
2	Age	The age (in years) of the periodical	46.43	32.56
3	Academic	Academic periodical (1=academic; 0=non-academic)	0.19	0.39
4	Frequency	Publication frequency per year	17.67	14.63
5	US	US periodical (1=US-based; 0=non-US-based)	0.74	0.43
6	Market (in log)	Annual worldwide ERP software revenue in billions of dollars in natural log scale	2.04	0.25
Independent Variable				
Business Problem				
7	Information Fragmentation	Total number of articles on information fragmentation problem per quarter	3.37	4.01
8	Operational Inefficiency	Total number of articles on operational inefficiency problem per quarter	3.53	4.88
9	Y2K	Total number of articles on Year 2000 problem per quarter	188.11	272.03
10	Legacy Systems	Total number of articles on legacy system problem per quarter	13.73	20.03
Other Innovation Concept				
11	MRP II	Total number of articles on manufacturing resource planning per quarter	8.83	8.08
12	BPR	Total number of articles on business process reengineering per quarter	99.81	55.05
13	EDI	Total number of articles on electronic data interchange per quarter	59.43	29.34
14	TQM	Total number of articles on total quality management per quarter	211.17	74.40
15	DSS	Total number of articles on decision support systems per quarter	71.07	11.94
16	CRM	Total number of articles on customer relationship management per quarter	118.29	62.34
17	SCM	Total number of articles on supply chain management per quarter	82.34	53.29
N=2816				

4. Results

Between October 1991 and December 2002, 201 periodicals published 2,270 articles on ERP in ABI. Table 2 shows the descriptive statistics of the 17 variables. ERP article count (Variable 1) is the dependent variable. On average, each periodical published 0.81 article on ERP in each quarter with large variations. Among the control variables (Variables 2-6), Academic (Variable 3) and US (Variable 5) are dummies. On average, these periodicals were in business for about 46 years, mostly US-based, non-academically oriented, and published approximately 18 times a year. Variables 7 through 17 are independent variables representing the two factors: problem discourses (Variables 7-10) and discourses on other IT concepts (Variables 11-17). TQM evoked the largest volume, while the information fragmentation problem discourse was the smallest. Table 3 shows that most correlations between independent variables and the dependent variable are small but statistically significant. The correlations between several pairs of independent variables are quite high, especially those between information fragmentation (Variable 7) and operational inefficiency (Variable 8) and between Y2K (Variable 9) and legacy systems (Variable 10). So I calculated variance inflation factors (VIF) to check on multicollinearity.[13] The VIFs for four variables exceeded 5, a threshold for multicollinearity concern (Menard, 1995): information fragmentation (5.43), operational inefficiency (5.33), Y2K (6.32), and legacy systems (5.48). Although these VIFs are still well below 10, another frequently cited threshold (Hair et al., 1995), I chose to include only one variable from each highly correlated pair in the subsequent regression analysis. As shown in the regression results below, one half of the regression models included information fragmentation and Y2K; the other half included operational inefficiency and legacy systems. After dropping highly correlated variables, the VIFs for all explanatory (control and independent) variables in every regression model were below 3, well below the recommended threshold for multicollinearity concern.

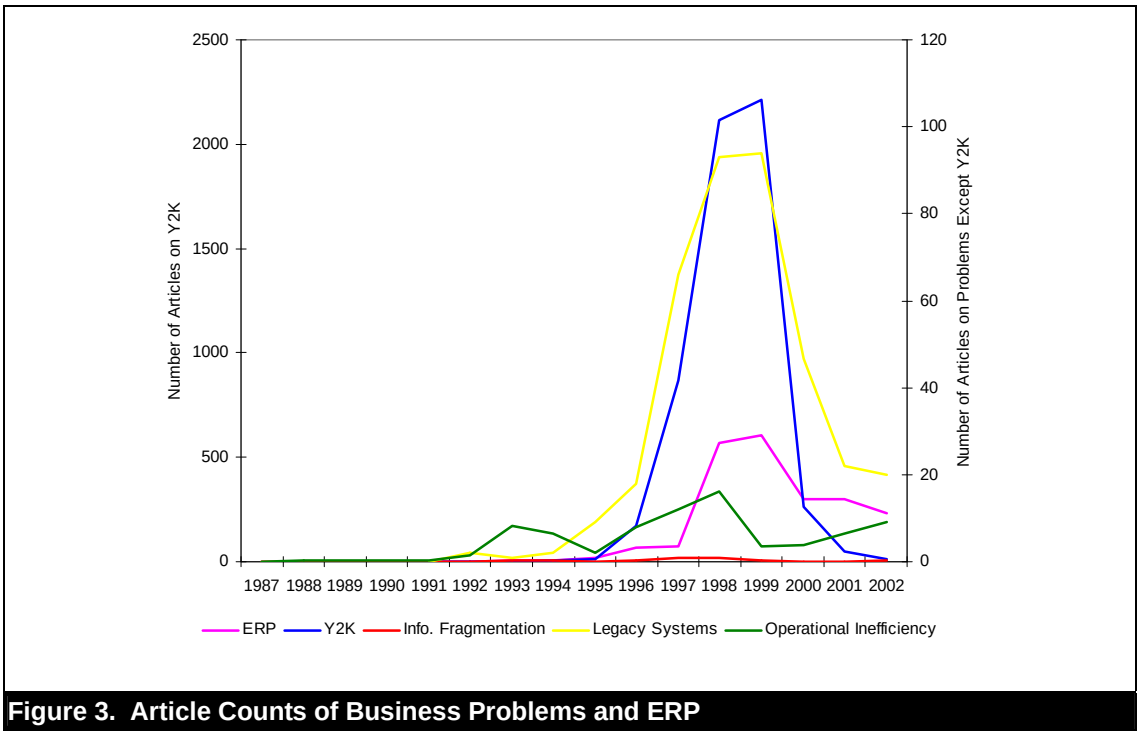


Figure 3. Article Counts of Business Problems and ERP

[13] As will be discussed later in this section, most estimated coefficients are stable in magnitude, direction, and statistical significance across various regression models. In this situation, high correlations among several independent variables may, at most, inflate the standard errors of coefficients, making the evaluation of significance more conservative.

Table 3: Correlations Among Variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	ERP																
2	Age	-0.11***															
3	Academic	-0.09***	-0.14***														
4	Frequency	0.24***	0.22***	-0.27***													
5	US	0.09***	0.11***	-0.24***	0.13***												
6	Market (in log)	0.12***	0.10***	-0.01	-0.03*	0.09***											
7	Information fragment.	0.21***	-0.01	-0.09***	0.14***	0.00*	-0.05**										
8	Operation inefficiency	0.19***	-0.01	-0.07***	0.16***	0.00*	-0.06**	0.92***									
9	Y2K	0.22***	0.05**	-0.09***	0.09***	0.03	0.48***	0.53***	0.48***								
10	Legacy systems	0.07***	0.01**	-0.07***	0.04***	0.01	0.07***	0.02***	0.07***	0.88***							
11	MRP II	0.07***	-0.04	-0.08***	0.13***	0.01	-0.29***	0.52***	0.54***	0.20***	0.11***						
12	BPR	0.09***	-0.05**	-0.07**	0.12***	-0.02	-0.38***	0.69***	0.72***	0.22***	0.09***	0.71***					
13	EDI	0.17***	-0.03	-0.11***	0.16***	-0.01	-0.10***	0.68***	0.65***	0.37***	0.12***	0.70***	0.78***				
14	TQM	0.04*	-0.07***	-0.05**	0.09***	-0.07***	-0.66***	0.53***	0.52***	0.05**	0.04**	0.49***	0.82***	0.58***			
15	DSS	0.13***	-0.04	-0.09***	0.13***	-0.02	-0.31***	0.64***	0.57***	0.36***	0.17***	0.68***	0.82***	0.79***	0.67***		
16	CRM	0.08**	-0.01*	-0.07**	0.11**	-0.03	-0.29**	0.42***	0.62***	0.25**	0.16*	0.35***	0.69***	0.54***	0.42***	0.30**	
17	SCM	0.07*	-0.03*	-0.08*	0.14*	-0.02*	-0.27*	0.54**	0.32**	0.23*	0.12**	0.54**	0.45**	0.53***	0.53**	0.21**	0.28*

N=2816 *p<0.05; ** p<0.01; ***p<0.001

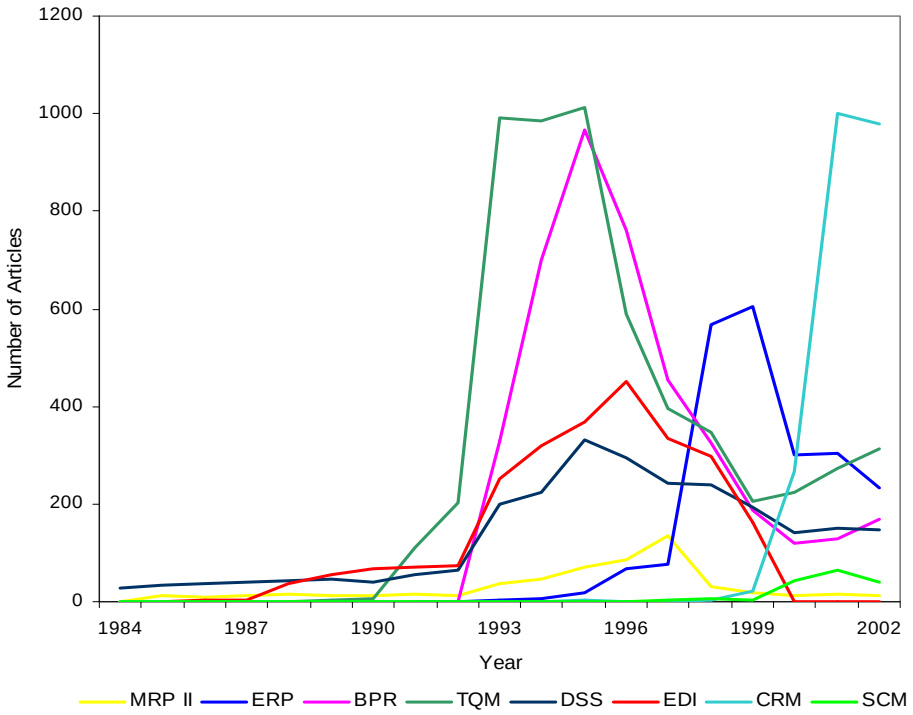


Figure 4. Article Counts of Other Innovation Concepts and ERP

Figures 3 and 4 portray the relationships between the ERP discourse and the two hypothesized factors. Because ABI itself has grown dramatically over the last three decades, all article counts in the figures were adjusted to factor out the variation in the total number of articles indexed by ABI.[14] As Figure 3 shows, the ERP discourse underwent a relatively gentle upswing until circa 1997-98 when it took a sudden leap until its decline starting in 2000. The rise of Y2K was remarkable and abrupt, which is highly correlated with the legacy systems discourse. In contrast, the discourses for information fragmentation and operational inefficiency were very small throughout. Figure 4 shows that relatively older innovation concepts (MRP II, BRP, EDI, TQM, and DSS), despite the varying degrees in their relations with ERP, reached their apogees and then began to decline when the ERP discourse was increasing. The aggregate discourse patterns shown in the figures do not show the specific context in which ERP's popularity rose and fell in each periodical as a result of multiple factors (the two hypothesized factors, control variables, and unknown factors as well). Regression analysis of observations made at each periodical would reveal more precise insights into the micro-dynamics of publishing ERP articles than matching the overall discourse patterns Figure 4 displays.

Table 4 shows the results of a series of negative binomial regression analyses. All data (1991-2002) were entered into Models 1 and 2. Due to the multicollinearity concern discussed above, Model 1 included information fragmentation and Y2K; Model 2 included operational inefficiency and legacy systems. The significant coefficient for the control variable "quarter" suggests the substantial effect of time. Thus, I divided the data into two periods: 1991-99 and 2000-02. The former was the ascendant phase of the ERP concept when its discourse was increasing; the latter was the descendant phase when ERP discourse was declining. Models 3 and 4 were estimated with the 1991-99 data. Again, each model included only one of each highly correlated pair of variables for business problems. Models 5 and 6 were estimated with the 2000-02 data.

[14] Following Abrahamson and Fairchild (1999), I multiplied the number of ERP articles in Year X by the ratio between the total number of articles indexed in 1996 and the total number of articles indexed in Year X.

Table 4: Results of Negative Binomial Regressions on ERP Article Count

	1991-2002				1991-1999						2000-2002			
	Model 1		Model 2		Model 3			Model 4			Model 5		Model 6	
Variables	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	S. Coef.	Coef.	S.E.	S. Coef.	Coef.	S.E.	Coef.	S.E.
Control Variables														
Age	-0.015***	0.004	-0.012***	0.003	-0.011**	0.004	-2.750	-0.013**	0.004	-3.250	-0.015**	0.005	-0.015**	0.005
Academic	-0.283	0.267	-0.295	0.229	-0.744	0.394	-1.888	-0.778	0.459	-1.695	-0.169	0.285	-0.169	0.310
Frequency	0.033***	0.008	0.035***	0.004	0.024**	0.008	3.038	0.033***	0.009	3.667	0.034***	0.007	0.023***	0.005
US	0.387	0.312	0.375	0.301	0.886**	0.335	2.645	0.904**	0.344	2.628	0.187	0.313	0.188	0.270
Market	2.759**	1.026	2.568*	1.012	3.850**	1.421	2.709	3.470*	1.375	2.524	-34.223	95.210	-30.452	88.938
Quarter	-0.052***	0.013	-0.047***	0.009	-0.089*	0.037	-2.405	-0.087*	0.035	-2.486	0.165	0.430	0.135	0.590
Independent Variables														
Business Problems														
Information fragmentation	0.032	0.018			0.047	0.028	1.679				0.045	0.132		
Operational Inefficiency			0.028	0.023				0.014	0.019	0.737			0.022	0.154
Y2K	0.001**	0.000			0.001***	0.000	3.597				0.005	0.005		
Legacy systems			0.021**	0.007				0.015***	0.004	3.750			0.009	0.006
Other Innovation Concepts														
MRP II	-0.019**	0.006	-0.018*	0.007	-0.018**	0.006	-3.103	-0.027***	0.007	-3.857	0.024	0.222	0.027	0.245
BPR	-0.004*	0.002	-0.004*	0.002	-0.006*	0.003	-2.400	-0.005*	0.002	-2.137	-0.047	0.116	-0.038	0.067
EDI	0.010	0.006	0.011	0.009	0.005	0.004	1.211	0.006	0.004	1.481	-0.025	0.102	-0.042	0.143
TQM	-0.001	0.001	-0.001	0.001	-0.001	0.002	-0.452	-0.002	0.002	-0.901	0.003	0.004	0.004	0.003
DSS	0.002	0.006	0.002	0.007	-0.001	0.007	-0.143	0.002	0.005	0.387	0.043	0.045	0.033	0.053
CRM	-0.006*	0.003	-0.007*	0.003	-0.009*	0.004	-2.184	-0.010*	0.004	-2.432	-0.022**	0.008	-0.024**	0.009
SCM	-0.005*	0.003	-0.005*	0.002	-0.006*	0.002	-2.609	-0.007*	0.003	-2.414	-0.019**	0.007	-0.015**	0.005
N	2816		2816		976			976			1840		1840	
Wald chi2 (df)	483.21 (16)		488.32 (16)		236.29 (16)			217.89 (16)			305.82 (16)		289.87 (16)	
Prob > chi2	0.000		0.000		0.000			0.000			0.000		0.000	
McFadden pseudo R^2	0.544		0.562		0.639			0.653			0.130		0.142	

*p<0.05; ** p<0.01; ***p<0.001.

The results from the Wald chi-squired tests (similar to the F-test in OLS regression) indicate that all models are significant (i.e., at least one of the regression coefficients in each model is not equal to zero). The significant effect of the ERP market size (as a proxy measure for adoption) suggests that more adoptions were associated with more popularity. Nonetheless, a check on the standard coefficients for the Market variable in Models 3 and 4 revealed that its effect was not dominant and there were other factors whose effects were relatively stronger (e.g., the effect of Y2K, which I will discuss momentarily). This significant but not dominant effect implies that popularity is not entirely induced from adoptions. Therefore, the reciprocal relationship between adoption and popularity depicted in Figure 1 is not a tautological loop and, thus, it is theoretically interesting to study other factors that shape popularity.

Models 1 and 2 show mixed results from testing Hypothesis 1, which essentially proposes that the prevalence of the problem linked to an IT innovation concept drives the number of articles each outlet publishes about the innovation. Both the information fragmentation and Y2K problems were linked to ERP. However, in Model 1, only the prevalence of the Y2K problem in discourse is significantly associated with the volume of the ERP discourse as hypothesized, whereas there is no evidence for any significant effect of the information fragmentation problem. Similarly, the operational inefficiency discourse does not show significant effects, but the discourse on legacy systems does. The mixed findings persist in Models 3 and 4 with the 1991-99 data. Hypothesis 2 proposes that closely related concepts rely on the same type of attention and, thus, the prevalence of a related concept should be negatively associated with the number of articles each outlet publishes about the focal concept. Consistent with this hypothesis, Model 1 shows that the four concepts (MRP II, BPR, CRM, and SCM) related to ERP were negatively associated with the volume of the ERP discourse. Distantly related concepts such as EDI and largely unrelated concepts such as DSS and TQM did not show significant influence despite that their downswing phases coincided with ERP's upswing as shown in Figure 3. Similar results were found in Models 2-4. For both hypotheses, however, Models 5 and 6 with the 2000-02 data showed that neither the problem discourse nor related older concepts had any significant influence on ERP's popularity during the descendant phase. However, the discourse on newer concepts (CRM and SCM) remained significantly negatively associated with ERP.

5. Discussion

Robust evidence was found that the discourses on Y2K and legacy systems and the four related innovation concepts (MRP II, BPR, CRM, and SCM) had significant associations with the volume of ERP discourse between 1991 and 1999.

5.1. Business Problems

The non-significant effect of the information fragmentation problem on the ERP discourse casts doubt on whether this problem that ERP was originally claimed to solve was a driver for the popularity of ERP. In fact, large organizations and their people have been frustrated by data management and information accessibility problems for decades. Various IT solutions have been introduced and implemented, but these problems (or their recent variants) have not been solved completely and therefore it is not uncommon for vendors and consultants to tout a new IT as an improved solution to information fragmentation. However, as indicated by the almost invisible curve in Figure 3, since the late 1980s discourse has failed to attract much attention to the information fragmentation problem, which could not help much with ERP's popularity. Likewise, the operational inefficiency problem did not generate much discourse or impact on the popularity of ERP either. In the early 1990s, the pertinent business problem addressed by ERP systems was not clear. Like other emergent concepts, ERP was "a solution in search of a problem."

Similarly, the Y2K problem had been negligible in the technical and management discourse since a 1984 *Computerworld* article reported William Schoen's first discovery of the problem and called managers to pay attention to it (Gillin, 1984). However, managers ignored this call, along with multiple pleas from the programming community to address the problem, until only a few years before the turn of the century. By the mid-1990s, as the apparent deadline was approaching, an increasing number of articles began to report that the potential danger of the Y2K problem and the effort needed to solve it had been underestimated. The nature and scale of the problem soon transcended the

technological realm to the broad economic, political, and social arenas. Armageddon scenarios in which the millennium bug wipes out the entire global civilization frequently appeared in the public discourse in the mid-to-late 1990s. Nevertheless, the heated discussion of Y2K attracted considerable attention from many fields of society and instigated widespread fear of the malfunctioning of power, water supply, telecommunication, transportation, and defense systems, etc. In this way, Y2K transformed from a date-field conversion issue to a multi-field social problem. Hence, ways to address it naturally corresponded to the "spirit of the times" and gained immediate popularity. Just as they had considered hoarding bottled water and other emergency supplies in their own households before year 2000 arrived, managers were receptive to "silver bullets" that would come along to fix Y2K in their organizations. Fixing Y2K was an extremely labor-intensive process by which millions of lines of software code in an organization's legacy systems had to be updated. After years of downsizing and outsourcing their IT departments, many companies no longer had the capability to undertake the conversion by themselves. They avoided the task by adopting Y2K-compliant ERP systems to replace their legacy systems. Y2K acutely symbolized a host of problems with organizations' legacy systems: high cost of maintenance, inefficiency, lack of knowledgeable workforce, etc. In this sense, ERP should not be viewed as overkill to the Y2K bug or problems with organizations' legacy systems more generally. Rather, Y2K and legacy systems, as widespread business problems, served as catalysts for ERP's own popularity.

5.2. Related Innovation Concepts

The inherent relationships between ERP and other innovation concepts may explain their differentiated associations in discourse. First, MRP II systems streamline information flows in core manufacturing processes, whereas ERP systems integrate information flows not only in manufacturing, but also in other processes and functions. Thus the ERP concept had to draw attention originally allocated to MRP II, as well as attention from people in other functions. In this sense, ERP is a much larger "species" that consumed more attention than MRP II did. That difference probably explains why the scale of ERP discourse far exceeded that of MRP II discourse in Figure 4.

Most intriguingly, the BPR movement advocated radical redesign of business processes with the goal of dramatic performance breakthroughs. In the early 1990s, most reengineering projects discarded existing processes and came up with brand new processes only to find that there were no information systems to support the new processes (Kleiner, 2000). On the other hand, when ERP systems were introduced to large companies, managers found that they had to change their existing business processes according to the "best practices" packaged in ERP. Hence, the decline of the BPR movement in the mid-1990s might have released the right type of attention (characterized by its focus on business processes) for the rise of ERP. Furthermore, ERP gradually became a means to do BPR, as more and more firms adopted ERP systems with specific embedded processes that they aspired to obtain (Davenport, 2000). Hence, the relationship between ERP and BPR became less and less competitive over time. To see this time-dependent effect, I added an interaction term (BPR X time measured in quarters) to the regression models (Models 1-4), and the coefficient for the interaction turned out statistically significant and positive. However, due to its relatively small coefficient value, this interaction effect could not reverse the overall negative relationship between BPR and ERP, merely indicating that their relationship became less negative over time.

In short, although it is difficult to argue that ERP, MRP II, and BPR addressed similar problems and resided in the same problem domain, it is fair to infer that ERP successfully drew relevant attention from these old concepts. On the other hand, ERP, CRM, and SCM, commonly referred to as typical applications of Enterprise Systems, inevitably consume similar types of attention, and their competition has been ever increasing. In contrast, EDI rose as a way to streamline the flow of transactional documents ***between*** businesses. While integrated systems and data ***within*** a business, promised by ERP, was a favorable condition for EDI, it was not a required condition. In fact, some firms engaged in labor-intensive manual processes to prepare the data for EDI. Accordingly, the analysis suggests that the discourses on EDI and ERP did not consume the same type of attention, as evidenced in the non-significant coefficient estimation for EDI. Similarly, the collapse of the DSS

and TQM concepts did release attention, but the attention probably was not the right type for ERP.

5.3. Effects Largely Vanished in 2000-2002

The effects of problem discourse and related older concepts on ERP disappeared in 2000-02, but the effect of related newer concepts on ERP remained (see Models 5 and 6 in Table 4). In the 1990s, hundreds of discourse outlets advertently or inadvertently developed common sensitivities and similar appreciations for ERP in response to the overall patterns of discourses on Y2K, MRP II, and BPR. By 2000, ERP had already been very popular and was no longer a novel concept to most members of the community. On the one hand, the ERP concept had already been legitimated and, thus, its popularity no longer needed to be constantly justified by links to widespread problems. On the other hand, attention to ERP was so substantial that competition with related older concepts became a non-issue. Taking both points into consideration, I suspect that the common sensitivities and similar appreciations for ERP might have fragmented in the new millennium. As ERP implementation projects were underway and various organizational constituents were occupied by implementation processes and outcomes in many organizations, the once intensive or even passionate sensemaking of ERP declined. Therefore, whether and how to continue covering ERP became largely dependent on the specific preference of each discourse outlet. At issue in this period, however, was the increasing competition between ERP and newer innovations such CRM and SCM.

6. Conclusion

The recent wave of mergers and acquisitions among enterprise software providers signifies a consolidating marketplace for material IT innovations. However, the marketplace for innovation concepts remains messy and inefficient (Pfeffer and Sutton, 2006). Anyone with an idea can enter and exit the marketplace with minimal cost. At any time, numerous IT innovation concepts are competing for the already scarce attention of practitioners. What these concepts propose and promote is often inconsistent and ambiguous. Their influence on the design, production, and use of IT in organizations is often different, and it is difficult to predict the impact of any particular concept. Thus far, IT innovation research has little to offer when it comes to the causes and production of IT innovation concepts and their consequences on the adoption and diffusion of IT innovations.

This paper has centered on the IT innovation concept, as opposed to the conventional focus on material innovation. Taking the perspective that an IT innovation concept evolves beyond the boundaries of organizations in a community, I have argued that the increased prevalence of an IT innovation concept in discourse, or its *popularity*, may lead to an increased likelihood of innovation adoption. Realizing that popularity is an often-talked-about but poorly understood concept itself, I have focused my empirical investigation on one question: What makes a concept popular? The empirical case study of ERP has three findings. First, when an IT innovation is framed as the solution to certain business problems, the prevalence of the problems that discourse highlights and brings to managers' collective attention is positively associated with the popularity of the innovation; whereas the prevalence of the problems that discourse fails to highlight has no effect on the popularity of the innovation. Second, the popularity of concepts *related to* the focal innovation concept is negatively associated with the popularity of the new concept, because they rely on the same type of attention; whereas the popularity of concepts unrelated to a new concept has no effect on its popularity. Third, the effects of highlighted problem discourses and older related concepts on the popularity of a focal concept disappear after the concept passes its peak popularity, but the influence of newer related concepts remains.

Interpretation of the findings should remain tentative due to several limitations. First, ABI only includes published written discourse. Although many articles quote content from interviews and speeches, published discourse is only one type of discourse and may not be representative. Other types of discourse should also be examined using effective methods such as observation, interview, and survey in future research. Second, although the articles on the problems of information fragmentation and operational inefficiency were carefully selected following conventional qualitative analysis procedures, the selection process may still have left out some articles that discuss these two problems in ways not detected by this method. Therefore, research in the future may explore

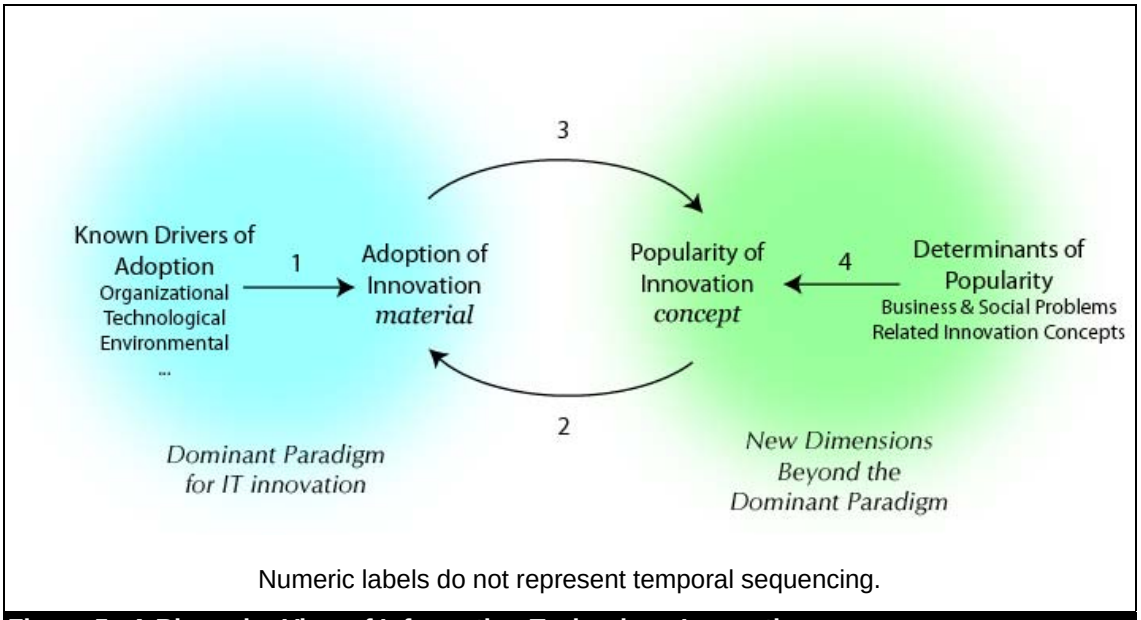
methods with higher reliability. Third, regarding the relationships between related innovations, this study only examined an *ad hoc* list of concepts, and their relatedness was heuristically inferred from previous literature. Future research should develop a more systematic method to select innovation concepts, formally theorize and measure their relatedness, and test the moderating effect of concept relatedness on popularity. Fourth, the empirical study has focused on only two factors (problem discourse and related innovations). Despite the significance of these factors, other drivers for popularity may also exist. For example, as alluded to earlier, future research could explore the influence of high-profile organizations producing or adopting IT innovations. Last, with respect to generalizability, although this single-case empirical study allowed me to generalize from the findings toward a theory of popularity, which, in turn, can be generalized to a richer theory of IT innovation (Lee and Baskerville, 2003), the findings themselves cannot be directly generalized to other innovation concepts. Therefore, an immediate direction for future research is toward validating the findings among other concepts, particularly associated with different levels of controversy, as highlighted by the discussion on Linux. Future research on multiple innovations should also examine the content of the discourse and assess how controversy and/or various sentiments shape the relationship between popularity and adoption.

Notwithstanding these limitations, this study responds earnestly to Fichman's call for IT innovation research to go beyond the dominant paradigm (Fichman, 2004). Theoretically, the paper contributes to the understanding of IT innovations along two new dimensions. The primary dimension is the innovation *concept*, as a complement of *material* innovation processes. Only by making the distinction between concept and material can one study and understand their relationship. I have argued that innovation concepts traveling across organizational boundaries constitute the reality of today's IT world and shape the diffusion of innovations in material form. In particular, after introducing and theorizing *popularity* of an innovation concept as a potentially important driver of adoption, the paper has gone further to investigate some of the determinants of popularity. The empirical findings suggest that framing an innovation as the solution to a problem may not necessarily make the innovation concept popular. Rather, links to a widespread business problem that discourse highlights and brings to managers' collective attention may popularize the innovation, even as an unintended or partial solution. This conclusion is consistent with findings from studies of popular management innovations (e.g., Abrahamson and Fairchild, 1999) and echoes Davenport, who argued that innovation concepts "that get picked up by the marketplace are the ones that resonate with the *zeitgeist*" (Kleiner, 2000, p. 30, original emphasis). Using Y2K and legacy systems as examples, the paper outlined a concrete way to discern and measure such resonance. Further, resonance with the zeitgeist might not guarantee imminent popularity if practitioners' attention has been exhausted by other related innovations. For that reason, had MRP II and BPR prolonged their popularity somehow, ERP would not have reached the popularity that it did in the 1990s. To varying degrees, innovation concepts are related in *idea networks* that have more dimensions and are more dynamic than any predefined problem domains or niches found in previous research on popular management innovations. The structure of these idea networks and their impact on innovation practice are just beginning to be understood. While this paper has made an initial contribution to that understanding, future research should explore the fascinating structure of attention flowing through the networks of innovation concepts (Davenport and Beck, 2001).

The other new dimension of IT innovation research is the community, comprising diverse actors interested in developing an innovation concept. As concepts rarely stay within the confines of any particular organization, the conventional organizational analysis is inadequate to explain the IT innovation phenomenon. An innovative user, the traditional focus of adoption research, did not introduce the ERP concept. An innovative vendor, the traditional focus of new product development and marketing research, did not introduce the ERP concept. Rather, ERP was introduced by the market research firm Gartner Group. This type of organization is often bundled with other players and factors in the background or context in conventional diffusion research. In launching the ERP concept, Gartner played a leading role. Yet, ERP gained popularity through joint development by vendors, users, consultants, and others in the community. Hence, community-level analysis of IT innovations is warranted (Wang and Ramiller, 2004). This study has analyzed the community members' on-going conversation, or discourse, about ERP. The findings suggest that such

communities of interest are dynamic in terms of membership and size. For example, some members of the MRP II community may have joined the ERP community, whose members might have later departed to join the CRM community. Future research should study the dynamic constitution of innovation communities, the differentiated influences of community members, and the process by which members launch innovation concepts and sustain their popularity through discourse.

Taken together, the new dimensions make up a new lens to look at the IT innovation phenomenon. This new lens has relaxed rigid or even unrealistic assumptions implicit in the dominant paradigm. For example, the new perspective does not assume that the adoption of innovation is an independent individual decision based entirely on bounded rationality. Rather, each adoption is informed by a grand concept produced by a larger community. Nevertheless, the new lens does not reject insights from the dominant paradigm. As Figure 5 shows, complementary views from both lenses constitute a binocular view, bringing us much closer to the reality of IT innovations.



Numeric labels do not represent temporal sequencing.

Figure 5. A Binocular View of Information Technology Innovations

Practically speaking, this study challenges both practitioners and researchers to pay attention to innovation concepts and their evolution on a larger stage. Today on that stage, ERP has lost its limelight to other popular concepts such as RFID (radio frequency identification). Before a vendor invests millions of dollars in a new product line for RFID, a company spends hundreds of thousands of dollars on adopting and implementing RFID, a consulting firm deploys an entire unit to consult on RFID, a researcher devotes a few of his/her most productive years to RFID research, and investors put billions in RFID stocks, they deserve to know *why* this 30-year-old technology[15] has become so popular today. Discourse analysis demonstrated here affords a useful tool for monitoring innovation concepts' popularity and for explaining that popularity. As Arrow 4 in Figure 5 suggests, discourses on the business problems and related concepts shape the focal concept's popularity. Those interested in RFID should be on the lookout for RFID's link to widespread problems "in the spirit" of our time and arguments regarding RFID's relationship with older innovations in the discourse. Based on their own evaluations of these claims and arguments, practitioners and researchers can then make informed decisions rather than jump on the RFID bandwagon mindlessly. Further, factors identified in this study such as problem discourse and related concepts can be used to forecast innovation concepts' popularity. In this sense, the paper joins the broader effort to predict *which*

[15] *RFID Journal* frequently asked questions, available www.rfidjournal.com/faq/16/52, current January 20, 2006.

innovation concepts will become highly popular. Notwithstanding the practical significance of the effort to predict, Alan Kay reminds us that "The best way to predict the future is to invent it". Understanding the determinants of popularity will arm ambitious actors with the essential knowledge about *how* to make potentially useful innovation concepts popular. These knowledge entrepreneurs are shaping the concepts that will in turn shape the future landscape of IT.

Acknowledgement

This study was supported in part by the Information Systems Research Program at UCLA Anderson School of Management and the National Science Foundation under grant IIS-0729459. I thank Cynthia Beath, Deborah Chen, David Firth, Kimberly Harris, Thomas Housel, Barbara Lawrence, Ben Lientz, Sue Newell, Sandrine Poissonnet, Olav Sorenson, Burt Swanson, Yutaka Yamauchi, and Lynne Zucker for their helpful comments and suggestions during this project. The paper also benefited greatly from the comments by *JAIS* Senior Editor Rob Fichman and the three anonymous reviewers.

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Journal of the Association for Information Systems

ISSN: 1536-9323