

POPULAR CONCEPTS BEYOND ORGANIZATIONS: EXPLORING NEW DIMENSIONS OF INFORMATION TECHNOLOGY INNOVATIONS

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ABSTRACT

This study of information technology innovations makes the distinction between innovation in conceptual form and material form. The findings imply that the popularity of an IT concept responds to the broader climate of business and society and relies on the available attention in a network of related concepts.

INTRODUCTION

Numerous concepts exist in the world of information technology. Client-server computing, knowledge management, and service-oriented architecture constitute notable examples that bring about profound innovations in IT practice. The dominant paradigm for IT innovation research is primarily focused on the adoption of new IT in material, rather than conceptual, form. Consequently, there has been little research to understand what an IT innovation concept is, who create the 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 new IT.

In this paper, I define an IT innovation concept as a collective idea for the development and utilization of an IT innovation. To account for the cause and effect of an innovation concept, one should examine the community that generates and develops it. Each community is composed of diverse organizations interested in an innovation and members of the community talk and write about the innovation. In this on-going conversation, concepts more prevalent or popular, I theorize, 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, my empirical study examined the popularity of ERP (enterprise resource planning), arguably the most popular IT innovation concept in the past few decades.

THEORIES

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, where various factors have been found contributing to organizational IT adoptions (Fichman, 2004). 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). I argue that the conventional focus on organization as the unit of analysis is no longer adequate and IT innovation research should go beyond the organizational boundaries.

IT Innovations Beyond Organizations

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, and the press. However, analysis confined within the organizational boundary of each adopter has so far given inadequate attention to actors and their activities in the larger interorganizational environment. A complete industrial infrastructure for an IT innovation requires vendor collaboration as well as support and sponsorship by others such as government agencies, research institutions, and industry associations (Lynn, Reddy, & Aram, 1996). I suggest that IT innovation research extend its focus from organizational analysis to a higher level. An IT innovation not only takes place in adopter or vendor organizations where it is materialized, but also exists in a community where adopters, vendors, consultants, journalists, analysts, academics, and others are interested in developing the innovation as a concept. It is the innovation concept that travels across organizational boundaries (Newell, Swan, & Galliers, 2000).

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 CRM (customer relationship management) community develops the CRM concept. The once leading vendor Siebel Systems, despite its dominance in that community, did not own 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, adopters, and consultants.

Innovation concepts shape the diffusion of IT innovations through community members’ ongoing conversation, or discourse, about the innovations. Discourse linguistically carries community members’ ideas, opinions, and beliefs underlying each concept. Students of discourse record the volume of discourse on particular 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 & Fairchild, 1999). This study thus focuses on the popularity of innovation concepts.

I define the popularity of an IT innovation concept as the prevalence of the concept in the discourse. 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 dwindles, its popularity declines. The past several decades have seen many IT innovation concepts undergone wide swings in popularity. Popularity of an IT innovation concept in the discourse 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. Therefore, IT innovation research may benefit from studying popularity of innovation concept as a promising new construct.

Hypothesis Development

Popularity is a property of an innovation concept, which belongs to the community where the concept is created and sustained. I examine the prevalence of an innovation concept in each outlet of published discourse for two reasons. First, discourse outlets in democratic societies independently select what topics to cover and how to cover them, mimicking the processes by which community members choose to participate in the community discourse. Second, publication outlets, through interactions with their readers, contributors, advertisers, and peers, can and do sense similar appreciation and common sensitivities for specific topics.

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 & Sutton, 1997). For an innovation concept to gain its 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 & 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 to its solution, and thus the likelihood that the innovation concept appears in a discourse outlet.

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. 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. An innovation concept consumes attention from the member organizations and their people in the community. 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 relevant to the object-oriented programming concept, but not so much to CRM, which thrives on the attention from a different group of people. So it can be argued that attention flows among related concepts. Hence the discourses on related concepts competing for the same type of attention should be correlated (negatively) in terms of their popularity, while discourses for unrelated concepts not competing for attention should not be correlated.

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

METHODS

To test the hypotheses, I chose to examine ERP as an initial step to understand the making of popularity. ERP is arguably the most popular IT innovation in the 1990s (Robey,

Ross, & Boudreau, 2002). 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. In April 1990 Gartner Group introduced ERP as the next-generation of MRP II (manufacturing resource planning). In 1992, market leader SAP introduced a client-server based ERP package that quickly conquered the European and US markets. By the end of 1998, more than 60% 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 to midsize companies, from European and US markets to Asia Pacific and Latin America, and 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, web-enabled applications have opened new market opportunities for ERP.

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. Specifically, I counted articles under specific subjects in ABI/Inform Global database (ABI hereafter). The first article on ERP appeared in ABI in October 1991 (Baer, 1991). The overall volume of ERP articles had been increasing 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.

Hypothesis 1 is concerned with the prevalence of business problems in discourse. One of the business 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 about the information fragmentation problem in ABI. In addition, the Year 2000 (Y2K) conversion issue was brought to managers' attention in the mid-1990s. Worried that their legacy systems might break down when Year 2000 arrives, many companies found it much easier 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.

Hypothesis 2 is about the relationship between an old innovation concept and a related new concept. Among the several dimensions that define ERP's relation with other concepts, the problems ERP addresses have been continuously evolving. 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. Lastly, I counted articles on innovations such as EDI, decision support systems (DSS), and total quality management (TQM), which may or may not be related to ERP. As illustrations, these five innovations plausibly represent a good range of relationships with ERP.

The ERP concept's popularity may have also come from the adoption of the material innovation. To control for the 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, four more control variables are included: each periodical's age, authorship and readership (academic/non-academic), frequency, and headquarter location (US-/non-US-based). To exclude the potential influence of time, a linear time trend (updated each quarter) was also included as a control variable. To infer causality, the dependent variable (ERP article count) was 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 to assume that topical decisions are updated at least once a quarter. Since the dependent variable is article count, negative binomial regression was used.

RESULTS

Between October 1991 and December 2002, 201 periodicals published 2,270 articles on ERP in ABI. On average, each periodical published 0.81 article on ERP in each quarter with large variations. These periodicals were in business for about 46 years, mostly US-based, non-academically oriented, and published approximately 18 times a year. TQM evoked the largest volume, while the information fragmentation problem discourse was the smallest.

When all data (1991-2002) were entered into the negative binomial regression model, the coefficient for quarter turned out significant. I thus 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. With the 1991-99 data, mixed results appeared 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, only the prevalence of the Y2K problem in discourse was significantly associated with the volume of the ERP discourse as hypothesized, whereas there was no evidence for any significant effect of the information fragmentation problem. Hypothesis 2 proposes that closely related concepts compete for attention and thus the prevalence of an old concept should be negatively associated with the number of articles each outlet publishes about a new, related concept. Consistent with this hypothesis, results shows that the two old concepts (MRP II and BPR) closely 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. For both hypotheses, however, regression using the 2000-02 data showed that neither the problem discourse nor related old concepts had any significant influence on ERP's popularity during the descendant phase.

DISCUSSION

Large organizations and their people have been frustrated by data management and information accessibility problems for decades. However, 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. 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). Managers had ignored this call along with multiple pleas from the programming community to address the problem up 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 from the technological realm to the broad economic, political, and social arenas. Armageddon scenarios where the millennium bug wipes out the entire global civilization frequently appeared in the public discourse in the mid-to-late 1990s. 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, defense systems, etc. In this way, Y2K transformed from a date-field conversion issue to a multi-field social problem. Hence, managers were receptive to "silver bullets" that would come along to fix Y2K in their organizations. Fixing Y2K was extremely labor-intensive process by which millions of lines of software code in an organization's legacy systems had to be updated. They avoided the task by adopting Y2K-compliant ERP systems to replace their legacy systems. In this sense, Y2K, as a widespread business and social problem, served as a catalyst for ERP's own popularity.

On the other hand, 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. Second, 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). 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.

CONCLUSION

The marketplace for innovation concepts remains messy and inefficient (Pfeffer & 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.

Their influences on the design, production, and use of IT in organizations are often different and it is difficult to predict the impact of a 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.

As its principal contribution, the paper enriches the theoretical view that social cognition drives the diffusion of IT innovations. Essentially, I contend that social cognition produces an innovation concept and that 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 revealed 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 and social 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.

REFERENCES AVAILABLE FROM THE AUTHOR