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The evolution of enterprise resource planning systems as an IT innovation: A performative perspective

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Introduction

IT systems have been characterized by its ability to continually evolve at a rapid pace. Newer IT systems—enterprise platforms and systems in particular—continue to grow in range, reach, and complexity. However, because existing theories have not sufficiently accounted for this character of IT systems in addition to other malaises, our ability to explain technological innovation has in turned become constrained (Lyytinen and Rose 2003; Pinch and Swedberg 2008).

While existing theories on IT innovation within the Science and Technology Studies ("STS") have provided deep insights into the social dynamics around the development of such innovations, their preoccupation with specific socioeconomic actors, such as users and developers, has led to the unintended neglect of other key stakeholders (such as academics) involved in the process (Pollock and Williams 2008; Van de Ven 2005). This becomes problematic not simply because newer IT systems by themselves are more complex and tightly coupled; but because the process of innovation has also moved significantly away from one dominant innovator to increasingly a community of innovators that fragment along roles, interests, as well as social and ideological commitments. Furthermore, these IT artifacts are not limited to one form but are extremely "open" to multiple usage and wide applications (Agarwal and Sambamurthy 2002). Our theorizing around IT innovation therefore needs to acknowledge the messiness that follows these "multiplicities" and better account for them.

This research-in-progress (RIP) article chronicles our ongoing and early attempt to address these issues in building an IT innovation theoretical framework grounded on the evolution of the enterprise resource planning (ERP) system. We first draw on social theories from science and technology studies to explain how traditionally larger and more complex IT systems are brought into existence and change over time. We then build on these theoretical foundations by turning to the Theory of Performativity as a potential theoretical lens to extend our understanding of IT innovation. Our ongoing research uses data on the development of ERP—a current and conspicuous exemplar of IT innovation. As part of this early foray in studying this extensive innovation process, we first identified the role of knowledge intermediaries, viz. academics, in the process of understanding and driving IT innovation. We conclude this article with our preliminary findings to illustrate the potential value of the performativity perspective.

Theoretical Framework

There is a rich stream of research in STS on how technological artifacts evolve. This body of knowledge shows that the process of IT innovation is not just technical but also social because technologies are endowed with social meanings (Hughes 1989). In other words, IT innovation is at once a social and political process, and a technical development. STS also argues that these social and political processes involve struggles and contests among different social groups holding differing cognitive perceptions and beliefs of the focal technology (or "technological frames") (Bijker et al. 1987). Thus, the portrayal of innovation process in STS is one of political interactions driven by different underlying technological frames; where technical development, in a sense, is subsumed under the social process.

STS, in particular those of the actor-network theoretical variant (ANT) (Callon 1986; Latour 1987), has pointed to the importance of material artifacts in the innovation process. They point out that IT innovations and artifacts cannot be neutral or passive agents in the innovation process because they carry inscribed logics and intrinsic designs that have important social and political implications (Akrich et al. 2002; Callon 1986). Furthermore, artifacts themselves also have their own history and trajectories that need to be taken into account in the process.

In sum, STS focuses our analytical view on the development phase where the form and function of the innovation is still being decided. It opens up the black box of the material aspects of the innovation and surfaces the social interactions that occur before it is finalized and determined. Yet, although STS have given us these theoretical building blocks, they cannot complete the task of understanding newer IT systems for three reasons. First, recent IT innovation involves technologies that are relatively more complex, given the greater number of underlying components and the potential linkages among them. For this, researchers need theories that can better address multiple parallel technical developments and artifact histories (Pollock and Williams 2008). The second reason is because IT innovation is not limited to one single form or function but is instead extremely open and has wide applications (Agarwal and Sambamurthy 2002). A set of innovation can be modular and combined into multiple configurations to produce different routines and functions. Here, we need to be able to consider plural accounts of the same set of innovation within our theorizing. Last, IT innovation is often the result of communities of related firms and innovators (Rosenkopf and Tushman 1994; Van de Ven 2005). Thus theory cannot simply focus on one set of local actors and their attending frames and need to bring a larger set of stakeholders and the different sets of discourse related to each community into its consideration (Garud et al. 2002; Swanson and Ramiller 1997).

It is on this final point that we seek to address specifically in this paper: knowledge intermediaries, specifically academics, are more than just naïve observers or arms-length chroniclers of technological conduct; they are active contributors to the products and production of IT innovation, especially through the sets of knowledge claims they bring to bear on IT innovation. A candidate theory that seems to build on STS and, at the same time, direct attention to the theory-artifact interactions is the theory of performativity proposed by Callon and his associates (Callon 2006; MacKenzie and Millo 2003). At the same time, by using a performativity view, we are contributing to this growing theoretical stream in IS research, such as how organizational knowledge is an ongoing social accomplishment that implicates both human action and material objects (Leonardi 2011; Orlikowski 2010; Orlikowski and Scott 2008), the evolution of enterprise systems in post-rollout environment (Wagner et al. 2010), and the changes in accountability through new performances of sociomaterial ensemble (Scott and Orlikowski 2012).

In the next section, we consider and elaborate the theory.

Enter the Theory of Performativity

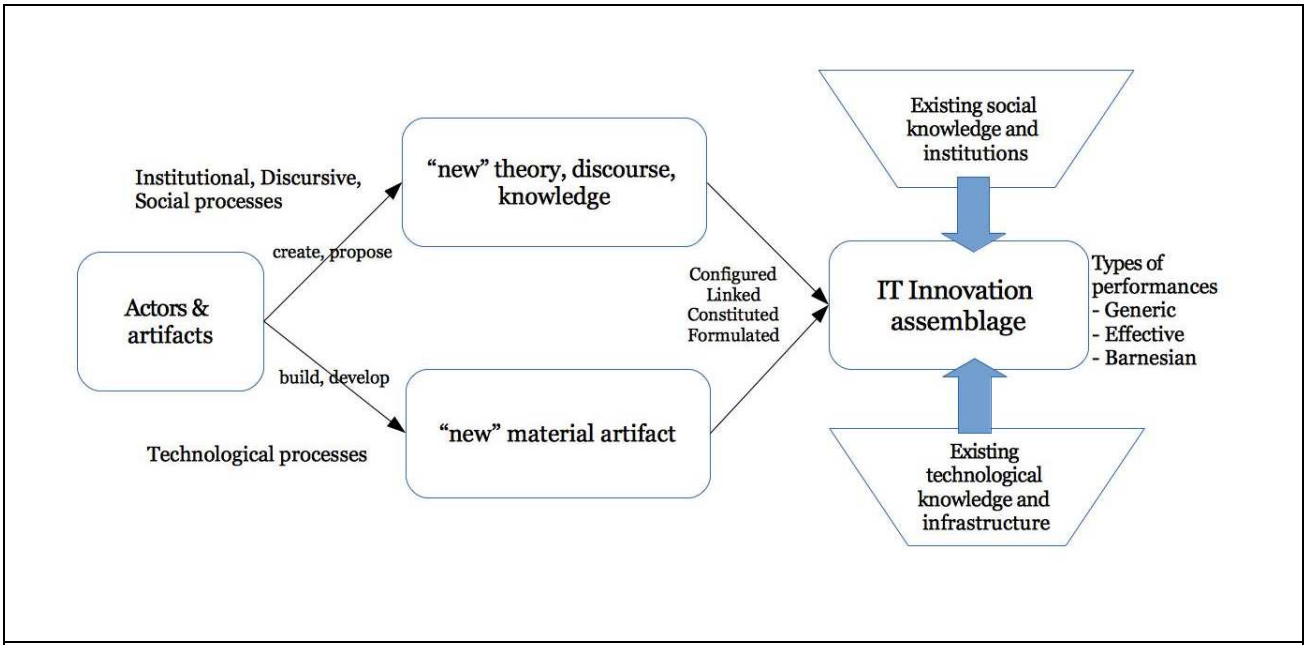

Figure. 1 Theory of Performativity – Broad Theoretical Framework

The theory of performativity is associated with recent work by Michel Callon, Fabian Muniesa, Yuval Millo, and Donald MacKenzie in the field of economic sociology (see Callon 2006; Callon and Muniesa 2005; MacKenzie and Millo 2003). Drawing on how Callon and his associates explain the rendering of economic theories performative as the economy, we argue that their theory of performativity has the potential to highlight academic involvement in the process of IT innovation. To better appreciate performativity, we discuss the key assumptions and principles of the theory and elaborate how they relate to IT innovation.

First, the theory of performativity holds to an ontological view where reality is not made up of discrete entities; instead reality is constitutively an entangled ensemble of people, discourse, theories, and material elements (Callon 2006; Callon and Muniesa 2005). This ontological stance not only resonates with STS' notion that both social and material elements play equally important roles in the innovation process, it goes further to highlight the tight relationships among these elements by treating them as an inseparable whole. More importantly, by explicitly pointing to discourse and theories, the theory of performativity reveals the discursive elements that academics bring to bear on IT innovation, specifically our theories and ideas (Wang 2009). Seen this way, the constitution of "IT innovation" under the theory of performativity is no longer limited to just its focal artifact(s). Instead IT innovation is understood ontologically as constituted by the entire ensemble of human actors, different material artifacts, particularly the knowledge claims and discourse that render it intelligible to the other stakeholders, such as developers, consultants, and vendors.

Second, Callon's (2006) notion of performativity focuses on the actions and work undertaken to make sociomaterial ensembles performative in specific situated sites. Here, he draws upon Austin's notion of "performativity" that point to the performative property of statements, as opposed to just being descriptive (or constative). However, instead of just focusing on how discursive elements (e.g., knowledge claims or theories) have performative property, Callon shifts our analytical gaze to the actions enacted by the different actors and artifacts that link discursive elements to material artifacts and devices so as to make the entire ensemble "perform". Applied to the "IT innovation process", the theory of performativity defines the IT innovation process as the actions undertaken by innovators, organizations, institutions, regulatory agencies that elaborate and link theories and knowledge of IT innovations to the material artifacts. It also redefines the success or failure of an IT innovation process by the entire ensemble's actual performance in reality.

This performative perspective of the innovation process therefore argues that innovation is not just about the one particular social process (viz. political process – albeit this is one major part). Rather it expands the process to include technological development, cognitive and discursive actions, e.g., theorizing, building organizing visions (Swanson and Ramiller 1997), and even institutional building actions (Garud et al. 2002). It also broadens our view of "who" is involved to include the less obvious, specifically intermediaries (e.g., organizations in the supply chain), related stakeholders (e.g., regulatory organizations) and parties involved in the dissemination and consumption of knowledge around innovation and artifacts (e.g., consultants, universities, industry media) (Pollock and Williams 2008; Pollock et al. 2007). Just as important, by considering the actual performance, the theory of performativity allows us to view the innovation as multiple performances, or multiple versions of working. This in a way takes into account the malleability of IT innovation.

Finally, Callon and Muniesa (2005) observe that performative process—in our case, the IT innovation process—usually involved multiple trials and errors through which different actors working collectively gradually adjusted, reconfigured, and reformulated the social, discursive, and material elements to produce successful outcomes as broadly defined by the theories. Part of the reason for the struggles is because such performative processes do not take place de novo—they are often built around existing social and technological knowledge, social practices and institutions, as well as material context. These existing ensembles, in which the new ensemble is being arranged and configured, tend to be highly obdurate and challenging for the innovators' efforts (Law and Singleton 2000).

In light of this, Mackenzie (2004) posits that there are several outcomes: a) "generic performativity", when an aspect of theory, model, concept, procedure, dataset, etc. is used and adopted by participants; b) "effective performativity", when the practical use of an aspect of theory has an effect on target innovation processes; c) "Barnesian performativity", when the practical use of an aspect of theory makes target

innovation processes more like their depiction by theory; d) "counter-performativity" when the practical use of an aspect of theory makes target innovation processes less like their depiction by theory.

Thus from the theory of performativity, we argue that one could understand the IT innovation process in the following manner. First, one has to identify the ensemble involved the process. This includes the heterogeneous arrangements of human actors, material artifacts, as well as the knowledge claims and discourse that are promoted by the actors and inscribed in the artifacts. Second, we need to carefully trace the actions undertaken by the actors in the ensemble via the different processes—social, political, institutional, discursive, and technological—to render the ensemble performative. Finally, we need to explicate the different performative episodes as marked by the four different performative outcomes associated with the different processes. Together, by following these different elements of the theory of performative theory, we have the broad skeletal structure of a theoretical framework that potentially helps better account for how the IT innovation process unfolds. The challenge and goal of our research is to fill in the "flesh" of how these elements actually "look" in reality and to build a grounded mid-range theory for specific classes of IT innovation, which in our case is the enterprise system class of innovations.

Methods

As part of our research effort, we seek to understand what were the different elements involved in the ERP innovation ensemble. Based on the extant research, there were potentially three key actor groups anchoring the ERP ensemble—the software innovators (e.g., SAP), the industry users and organizations, and the intermediaries that included consultants, business press and academics (Pollock and Williams 2008; Pollock et al. 2007).

Given that we are interested in the innovation process, we decided to adopt a historical approach and to collect archival data on these three groups, in order for us to start tracing the rest of the ensemble. However as part of this RIP, we decided to narrow our scope of data collection and analysis to begin with one segment of the third group i.e., academics. We chose academics for three reasons. First, researchers have started looking at consultants (Pollock and Williams 2008) and there have been quite a few case studies on business users (Soh et al. 2000; Wagner et al. 2006; Yeow and Sia 2008), but few studies have considered the role of academics in IT innovation processes. Second, we also assert that the academic stakeholder could be useful in our early foray of data collection and analysis because of academics' access to both industry and innovators. This is especially so if we follow the linear model of innovation, where research is the fount of knowledge that presumably feeds consultants and business users who ultimately create the products that reach the market (see, for example, arguments made in Brooks 1996). In fact, if our assertion is accurate, we expect to find textual traces (albeit lagged) of how these stakeholders may have acted and interacted over the course of ERP's innovation. Third, by turning to academics who are the least studied, we build the possibility later in our studies to understand the extent to which the ERP innovation ensemble is performed by all three stakeholder groups.

To examine the role academics play in the performative rendition of ERP innovation, we turn to the products that they create: Texts. As "unintended testimony to past actions" (Scott 1990, p. 5), texts crystallize the interests and judgments of the community of IS knowledge intermediaries, including those produced in the business press and by consultants. Specific to academics, text in the form of archived research publications further carries imprints of the broader ideational and institutional commitments that they inherit and enact. Just as important, besides being systematic and reliable records of discourse, treating archived publications as data also avoids the recollection bias inherent in more obtrusive methods, such as field interviews and observations (Wang 2009).

We begin our investigation with the proceedings of the International Conference on Information Systems (ICIS). We have two reasons for doing so. First, while journals are generally in more definitive shape due to refinements made through multiple review cycles, conferences typically serve as the inaugural avenue for researchers to present their preliminary findings and test their developing theoretical frameworks so as to receive feedback for improvement. Second and specific to ICIS, it is the premier site for the IS academic community to feature its latest and possibly most cutting-edge ideas and research available on information systems (for example, see Walstrom and Hardgrave 2001). Both reasons suggest that ICIS therefore counts as a suitable *first* site to uncover forming knowledge claims about ERP as an IT innovation. In our concluding section, bearing in mind that we begin with a focused but limited search on

the ICIS proceedings, we balance the cautious optimism from our findings with elaborating how we intend to expand our coverage to other sources, including academic journals.

Using the AIS electronic library (AISeL), we search the ICIS proceedings using "enterprise resource planning," the long form of ERP. We choose to start from the year 1994 because literature suggests that interests on our focal innovation, ERP, seem to appear in 1997 but peak by the early 2000s (Westrup 2005). It is also in 1997 that ABI/Inform Global Database acknowledged ERP as an independent category as a result of the volume of publications that discussed it as a main topic (Wang 2009). Beginning our data collection from 1994 therefore gives us sufficient "room" to observe the ascent of ERP in the ICIS proceedings.

Our search retrieved 275 unique papers. For coding and analysis, we further limit the pool of papers to those that are empirical studies on ERP implementation as they provide the most conspicuous discursive demonstrations of knowledge claims academics make based on how they make sense of how IT innovation materializes in the field. With this in mind, we concurrently eliminate those that are either (1) meta-studies on ERP like ours, (2) focus solely on theory building, or (3) mention ERP only in a nominal manner. To elaborate on the third class of papers that we remove from consideration, we refer to studies in their discussion of packaged solutions, mention ERP as a cursory example. We are still coding the papers. At this point in time, we focus on bracketing "codable moments" (Boyatzis 1998) – fragments of text in the materials and our notes that relate to a) human actors, b) knowledge claims and discourse about ERP about its professed utility by various stakeholders and c) the processes through which it can be rendered intelligible and effective.

Next, we present our preliminary findings, specifically some descriptive statistics and vignettes from our ongoing analysis. When discussing our findings, we also point out shifts in our coding in practice at suitable junctions to take into account what is emerging in our process of analysis.

Preliminary Findings

At this early stage of coding, we are already intrigued by what we have found so far. Our preliminary analysis of the 275 papers shows that the trajectory of ERP is still not only rising, but also rising at an accelerated rate (see Figure 2). We also confirm Westrup's (2002) observation that the term "ERP" did not appear in ICIS before 1997. Still referring to Figure 1, the judgment of the decline of ERP as a feasible IT innovation which seems justified then now appears to be premature (e.g., Westrup 2005), especially when we take into account its sustained and accelerated proliferation in articles since 2005.

As we code, we start to see the co-occurrence of ERP with other discursive concepts such as business process reengineering ("BPR") and business process management ("BPM"). We therefore begin to code for both other terms as well. There seems to be a divergence between article counts on ERP and that of BPR and BPM. From Figure 2, we observed that the link between ERP and other concepts began to be delinked from 2003, and that it became more delinked from 2005. Fewer studies mention ERP and BPR or BPM in tandem. While not being shown here, we also code for a legacy term manufacturing resource planning (MRP). The article counts are not only low and sporadic, but they also do not exist independently of ERP. In other words, all articles that mention MRP do so in the context of ERP.

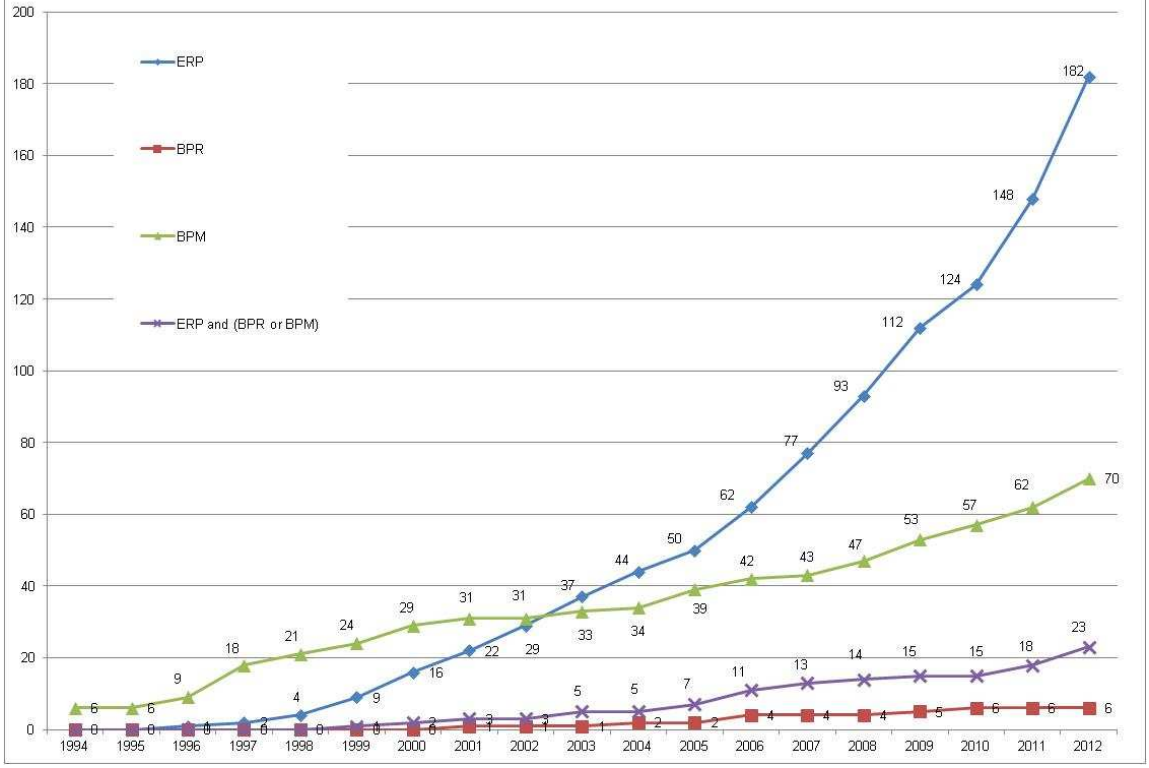

Figure 2. Cumulative Article Counts of ERP

Putting the above preliminary observations in terms of the theory of performativity, the performance of ERP artifact-concept to some extent seems to be linked to other discursive elements i.e., BPR or BPM, especially in its early period of its innovation (see Figure 3). However, its ascent seems decoupled from them very quickly. This observation provides tentative corroboration with the account that acts of performativity–ERP as an IT innovation in our case—do not take place de novo: its existence leverages existing knowledge claims, even that of legacy artifacts (i.e., MRP). It reflects that while the new ensemble is being arranged and configured, existing ensembles –even exiting and residual ones—tend to be highly obdurate. We further observe this persistent nature from the knowledge claims about ERP from both before and after the point of inflexion (in 2005). For example, in Poston and Grabski's (2000) study about the impact of ERP on firm performance (in the economic sense):

> Since ERP implementations are often performed with business process reengineering (Davenport 2000; Grabski et al. 2000; Wortmann 1998), the separate effect cannot be disentangled (p. 480).

Then in Bhattachraya's (2010) study that was published well beyond 2005, we continue to see the definition of ERP systems to be expressed in terms of streamlining and integrating business processes, despite the claim that ERP should "enable business value creation (beyond operational efficiency) in strategic business transformations in large organizations" (p. 4).

In fact, we are starting to observe the curiously self-serving tendency that business problems are framed in such a way that necessitates ERP as the intervention, often without explaining why a phenomenon is problematic in the first place. Casting the observation of diffused and un-integrated IS as a problem can only be resolved by, well, a tightly coupled and integrated IS. The material ERP system, therefore, as the naturalized solution is discursively performed, as we observe in Rowe et al.'s (2005) study:

> These shared information systems have been diffused rapidly and extensively, especially across large firms (Parr and Shanks 2003). Even small organizations are increasingly

> installing them (Van Everdingen et al. 2000). ERP systems are more integrated than conventional IS because the different modules are designed to be tightly coupled and their evolving architecture and expanding functionality promise cross-functional integration of all information flowing through a company (Markus and Tanis 2000) (pp. 521-522.

Future Steps

We hope that the glimpses from our ongoing coding and analysis offer some optimism and promise that the theory of performativity can address some of the issues associated with existing theories on IT innovation. As we continue to examine the articles from the ICIS proceedings, we will start to add other publications for analysis. Besides other prominent IS conferences such as AMCIS, PACIS, and HICSS, our candidate publications will need to include top journals, such as the *MIS Quarterly* and the *Journal of Management Information Systems*, because they are well established and accredited sources of scholarly work.

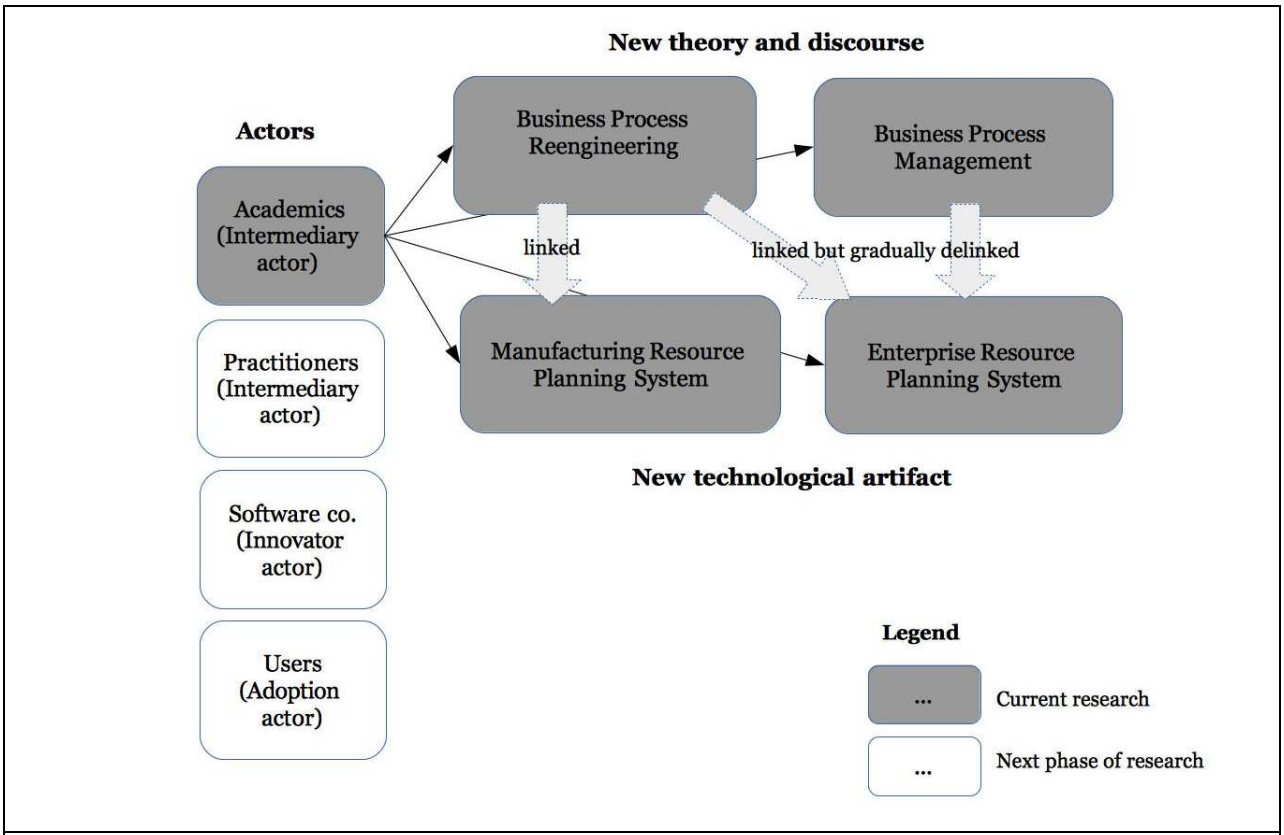

Figure 3. Current findings and proposed areas of research

We also find Pollock and William's (2008) notion of intermediaries in how they facilitate the performance of ERP, in particular those who "help shape expectations about the development of technological fields and constitute markets for constantly changing supplier offerings" (p. 12), useful in identifying other producers of knowledge claims (such as practitioners and industry analysts, using Pollock and William's (2008) example). This in turn also leads us to consider non-academic but equally ideational products, such as trade publications and technical reports (see Figure 3).

The next step also involves extending data collection to consider the other inter-related actor groups i.e., the software innovators (e.g., SAP), the industry users and organizations. In addition to coding for the discursive elements as per our current analysis, we intend to also focus on actions and processes undertaken by the other actors e.g., technical developments, political negotiations, institutionalization,

and carefully trace how these relate to the discursive elements and actions. The goal is to clarify what discursive elements are associated with which actors and what actions or processes.

We intend to trace the actors, actions, material and discursive elements through the development of ERP system over time (1994-2012). We will also code for important episodes of performative outcomes based on MacKenzie's (2004) taxonomy of performativity (i.e., "generic performativity", "effective performativity," "Barnesian performativity," and "counter-performativity"). This would aid us in understanding what are the prevalent modes of performativity that engender ERP to remain a salient IT innovation, vis-à-vis its existing and upcoming competitors, to solve business problems. As in interpretive research, we shall iterate between our theoretical framework and data and empirically ground the IT innovation process model to approximate what our data is telling us (Glaser and Strauss 1967; Klein and Myers 1999).

In conclusion, we repeat and clarify the potential contributions from our paper. First, we build on existing STS research and draw on the Theory of Performativity to develop a broad IT innovation theory. Second, we have collected (and will collect more) archival data on the evolution of the enterprise resource planning (ERP) system. We intend to analyze the data with the broad performative-based innovation theory to develop a grounded theoretical framework of IT innovation process. Finally, we argue that this performative perspective on IT innovation would help us better theorize the IT innovation process, particularly the dynamics of modern IT systems' development.

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