

Employees' reactions to IT-enabled process innovations in the age of data analytics in healthcare

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IN THE AGE OF ANALYTICS**

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Abstract

Purpose

Interorganizational business process standards (IBPS) are IT-enabled process specifications that standardize, streamline, and improve business processes related to interorganizational relationships. There has been much interest in IBPS as organizations from different industries implement these process standards that lead to successful organizational outcomes by integrating and standardizing intra- and inter-organizational business processes. These process standards enable data analytics capabilities by facilitating new sources of interorganizational process data. The purpose of this study is to unearth employees' reactions to a new type of supply chain process innovations that involved an implementation of new IBPS, a supply chain management (SCM) system and associated analytics capabilities.

Design/Methodology/Approach

We gathered and analyzed qualitative data for a year from the employees of a healthcare supplier, a high-tech manufacturing organization, during the implementation of a SCM system and RosettaNet-based IBPS.

Findings

In what we termed the initiation stage, there was quite a bit of confusion and unrest among employees regarding the relevance of the new process standards and associated analytics capabilities. With the passage of time, in the institutionalization stage, although the situation improved slightly, employees found workarounds that allowed them to appropriate just part of specific processes and the analytics capabilities. Finally, once routinized, employees felt comfortable in the situation but still did not appropriate the new supply chain processes faithfully. Overall, employees' reactions toward the SCM system and associated analytics capabilities were different from their reactions toward the new business processes.

Originality/Value

We contribute to the literature by offering novel insights on how employees react to and appropriate process innovations that change their work processes.

Keywords: Interorganizational business process standards, business process change, RosettaNet, interorganizational systems, supply chain management, data analytics.

INTRODUCTION

In today's hypercompetitive global economy, efficient and effective execution of interorganizational business processes (e.g., supply chain processes) is a key to firm performance (Tang and Rai, 2014; Rai et al., 2006; Venkatesh and Bala, 2012). Organizations implement information technologies (ITs) to make these processes more effective and efficient (Fosso Wamba, 2012; Fosso Wamba et al., 2015a; Rai and Tang, 2010; Rai et al., 2006). In recent years, organizations have started building analytics capabilities to further improve their operations and business processes (Chen et al., 2012; Fosso Wamba et al., 2015b; McAfee and Brynjolfsson, 2012). Healthcare, the largest sector in the U.S., lags in terms of leveraging IT to improve organizational processes, including supply chain processes (Fosso Wamba and Ngai, 2013; Min, 2014; O'Neill, 2008; Sinha

and Koenke, 2009). In fact, ineffective supply chain processes is a major concern for healthcare administrators because of its adverse effect on the quality of care and healthcare costs (Brody, 2007; Fosso Wamba, 2012; Min, 2014; Sinha and Koenke, 2009). Given that healthcare costs (about \$3 trillion) represent about 18% of the U.S. GDP and is expected to reach about 20% of the GDP by 2022 (approx. \$5 trillion) and 25% of these costs are supply chain-related (CMS, 2015; Wettstein, 2014; World Bank, 2015), ineffective SCM can have substantial financial implications. Hence, improving supply chain processes in healthcare is of great importance to various stakeholders in the healthcare industry (e.g., professionals, administrators, policy makers, and customers. It has been suggested that implementation and use of IT-enabled SCM systems, process innovations, and analytics capabilities are keys to improving healthcare supply chain (Brody, 2007; Burns, 2002; Fosso Wamba, 2011; Min, 2014). Therefore, successful implementation of IT-enabled SCM systems and processes in healthcare is of importance to researchers and practitioners alike.

Researchers have suggested many different designs for supply chain and means to improve supply chain processes in organizations in general (e.g., Cachon and Fisher, 2000; Lambert and Cooper, 2000, Vonderembse et al., 2006)) and healthcare organizations (HCOs) in particular (e.g., Burns, 2002; Min, 2014; Neumann, 2003; Sinha and Koenke, 2009). *Interorganizational business process standards (IBPS)*—open specifications for integrating and automating collaborative business processes using IT—have been suggested as a new way to improve supply chain performance and analytics capabilities (e.g., Bala and Venkatesh, 2007; Gosain et al., 2003; Markus et al., 2006 ; Nelson et al., 2005; Zhao et al., 2005; Venkatesh and Bala, 2007, 2012). Further, organizations implement enterprise systems (ES) to support supply chain activities (e.g., Bala, 2013; Mabert et al., 2003) that further facilitate big data capabilities by supporting data sourcing, storing, and use. Implementation of IBPS and ES often requires changes in existing business processes. Employees typically have strong emotional reactions toward process change initiatives, including process standardization (Long, 2004; Melone, 1995). Due to the complexity of the healthcare industry because of the presence of many different stakeholders and professional groups, we expect that implementation of IBPS will be critical as well as a significant challenge for HCOs (Kaplan and Robeznieks, 2014). We suggest that IBPS and associated analytics capabilities can lead to greater supply chain performance only if employees who are

responsible for executing interorganizational processes and performing analytics favorably react to these changes. Therefore, understanding employees' reactions during IBPS and SCM system implementation is critical for the successful implementation and use of these process standards in healthcare.

Much prior research on SCM has been at the organizational level (e.g., Malhotra et al., 2005; Rai et al., 2006; Tang and Rai, 2014), including various supply chain issues, such as optimization, effectiveness or success of supply chain and its determinants, supply chain relationship, and the role of IT in supply chains (see Venkatesh, 2006). Notwithstanding such prior work, there is little or no research that examined the effect of new supply chain process standards and analytics capabilities on employees who are responsible for executing supply chain processes in the healthcare industry. Similarly, prior work on business process changes has not focused much on employees' reactions to process change. This research has focused primarily on two areas (see Sarker and Lee, 2002): (1) process design research (e.g., Basu and Blanning, 2003; Malone et al., 1999; Pentland and Feldman, 2008; Pentland et al., 2011) and (2) process implementation and management (e.g., Ravichandran and Rai, 2000; Tang and Rai, 2014; Venkatesh and Bala, 2012; Wang and Tai, 2013). Although both streams provide rich insights on the nature and design characteristics of business processes and how organizations may (re)design and implement them, there has not been much research on how employees react to business process changes and adapt new business processes in HCOs.

Our research questions thus are: (1) *how do employees react to supply chain process standardization in the context of healthcare supply chain?* and (2) *how do these reactions unfold over time?* To answer these questions, we conducted a year-long qualitative study of the implementation of an ES and RosettaNet-based IBPS in a healthcare manufacturer and supplier organization. As these IBPS were independent of the ES, we understand the *unique* reactions to the new business processes vis-à-vis the ES that supports these processes. We build on structuration theory (Giddens, 1984; Orlikowski, 1992; Walsham, 2002) to understand the relationships among the processes, ES, and employees in a healthcare supplier.

CONCEPTUAL BACKGROUND

In this section, first, we review the literature on business processes and its relationship with ES followed by a discussion of the importance of process standardization in healthcare. Next, we discuss structuration theory

in the context of ES implementations and business process changes.

Business Process and Enterprise Systems (ES)

A business process is defined as a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs (Basu and Blanning, 2003; Davenport, 1993). Business processes are the fundamental building blocks for organizational value chain activities, such as SCM, logistics, and marketing. Examples of enterprise-level business process are: order fulfillment, application processing (e.g., loan applications), new product development, customer services, inventory management, and financial planning (Davenport, 1993; Smith and Fingar, 2003).¹ Business processes are important for several reasons. First, business processes are the foundation for corporate strategy and the basic unit of competitive advantage (Grant, 2002; Ray et al., 2004; Stalk et al., 1992). They are the mechanisms by which organizational resources and capabilities (e.g., IT initiatives, data analytics capabilities) provide ultimate value, such as positive economic outcomes (Davenport, 1993; Ray et al., 2004). Second, clearly structured and routinized business processes can improve organizational reliability, generate customer value, and improve interorganizational relationships (Davenport, 1993; Gosain et al., 2003; Hannan and Freeman, 1984; Rai et al., 2006). Third, the effectiveness of business processes is believed to be a more accurate measure of corporate performance as opposed to a global firm-level measure because an organization may possess competitive advantage at the level of business processes that may not be reflected in the organization's overall performance (Ray et al., 2004). Process metrics are even more important for HCOs as these organizations are typically organized around processes, such as clinical, administrative, financial and supply chain. Finally, various forms of business process innovations, such as *process improvement*, *process reengineering*, *process redesign*, *process optimization*, *process integration*, and *process standardization*, are keys to the success of much organizational activities (Davenport, 1993; Gosain et al., 2003; Hammer and Stanton, 1999; Thong et al., 2000, 2003). In recent years, these process innovations are complemented by analytics initiatives due to the abundance of data being

¹ Although process concepts have long been used by researchers to understand the characteristics of organization structure, work role behavior, and resource interdependence, it was only in the 1990s that the concept of a process gained significant attention due to an increased focus on business process reengineering (BPR) initiated by large organizations (Grover et al., 1995). Since then, a process view of business has gained prominence as process innovation was recognized as a key driver of performance improvement in the face of intense competition, globalization, and demand idiosyncrasies (Davenport, 1993; Ray et al., 2004).

generated and captured, and availability of analytics tools and capabilities (Chen et al., 2012; McAfee and Brynjolfsson, 2012). Although process innovation failures are often reported, a careful and systematic approach to IT-enabled process innovation could help obtain various positive outcomes, particularly for HCOs as they attempt to reduce variation, uncertainty, and ambiguity in their processes (Burns, 2002; Davenport, 2000).

ES and business processes are closely related (Davenport, 1998; Davenport, 1993; Mabert et al., 2003; Markus and Tanis, 2000) because business processes are *enabled* or *constrained* by ES (Broadbent et al., 1999; Davenport, 2000; Hammer and Stanton, 1999). Although other types of IT (e.g., word processor) can affect how employees execute their tasks, HCOs can implement ES to automate and support different clinical and administrative processes (Devaraj and Kohli, 2000; Soh et al., 2000). However, implementation of these systems typically involves substantial changes in existing IT infrastructure and an extensive redesign of or changes to existing processes (Davenport, 2000; Davenport, 1998; Gattiker and Goodhue, 2002). For example, a SCM system can provide a structure for the flow of cross-functional and interorganizational activities (e.g., sourcing, procurement, shipping) and enables collaboration, planning, execution, and coordination of the entire supply chain for HCOs (Davenport, 2000), thus requiring radical changes in the existing business processes associated with these activities. Due to such changes, the ramifications of an ES for HCOs are more complex and far-reaching than that of simpler applications, such as productivity tools or transaction processing systems (Bingi et al., 1999; Nandhakumara et al., 2005).

Process Standardization in Healthcare

The importance of process standardization for HCOs has been underscored in the academic and practitioner literatures (e.g., Brody, 2007; GS1 US, 2015; Kaplan and Robeznieks, 2014; PricewaterhouseCoopers, 1999). Despite the availability of technologies needed to standardize business processes, the healthcare industry lags in terms of leveraging these technologies to standardize business processes. Healthcare is one of the sectors that can dramatically improve the quality of service and efficiency of service delivery through process standardization. Process standardization can help HCOs reduce variation, uncertainty, and ambiguity during process execution (Kaplan and Robeznieks, 2014). It will offer a clear guideline for the orchestration of

sequential activities performed within a process (Davenport, 2005). It will create a single face of the organization for the external stakeholders, such as patients, suppliers, insurance providers and other agencies. A standardized process requires accurate and timely information and clear guidelines on the flow of events. IT can provide required information and guide through the flow of events by giving notification and maintaining audit trail of events. Thus, when integrated with IT infrastructure and capabilities, the standardized and integrated processes can ensure consistent and efficient continued healthcare services.

Although process standardization is critical for HCOs, these organizations face several unique challenges in adopting and implementing process standards, such as IBPS for SCM (Ramanujam and Rousseau, 2006). First, the healthcare industry is a complex economic sector comprising organizations with multiple and often conflicting missions. Although the core mission of these organizations is to provide safe, effective, timely and equitable patient care, they differ significantly in terms of their emphasis on clinical care, community service and outreach, teaching, research, profits and in some cases, religious values. These factors dictate organizational culture and propensity to invest and embrace innovations. For example, a non-profit HCO may not be interested in spending millions to implement IT-enabled IBPS. Second, HCOs typically consist of multiple professionals who socialized in significantly different settings (Ramanujam and Rousseau, 2006; Venkatesh et al., 2011). These professionals possess qualitatively distinct set of goals and professional values (Garman, 2006). For example, healthcare administrators who have a degree in business may not share the same values that physicians and other clinical stakeholders share (Garman, 2006). Even when physicians become administrator, they do not necessarily share the same values that other administrators in and outside the organization may share due to different organizational and professional identification that physicians possess (Hekman et al., 2009). Similarly, healthcare providers may not have the same disposition toward adopting and implementing IBPS that healthcare suppliers may have. Third, HCOs face a complex industry environment comprising multiple external stakeholders who influence them in myriad ways (Ramanujam and Rousseau, 2006). For example, healthcare providers are influenced by various governmental agencies, insurance providers, accreditation agencies and professional associations. Therefore, adoption and implementation IBPS that span multiple stakeholders are daunting tasks and require complex decision-

making by different stakeholders (e.g., Hess et al., 2006).

Finally, the task environment in the healthcare industry is complex, ambiguous, and dynamic (Ramanujam and Rousseau, 2006). Although the clinical practices are indeed complex, the supporting processes, such as financial, administrative, and supply chain, are also complex and ambiguous due to the presence of multiple stakeholders that may or may not share the same value system and culture. The issue of a complex task environment is even more pertinent to the implementation of IBPS as these standards dramatically change the existing task environment related to SCM. For example, after the implementation of IT-based IBPS, employees in a healthcare supplier who used to receive orders from healthcare providers through phone or fax will receive orders real-time and have to process the orders within a certain time period dictated by IBPS. Given that the quality and accuracy of order fulfillment is of immense importance in the healthcare supply chain, employees may feel that their workloads have increased significantly following the implementation of IBPS. Consequently, they may develop negative reactions toward these process standards. Our focus in this research is to understand employees' reactions to process standardization in HCOs.

Structuration Theory

The structuration² and related theoretical perspectives (e.g., human agency, organizational learning, and practice lens)³ help us understand the *dynamics* of the relationships among technology, human agents, and social contexts (Black et al., 2004; Orlikowski, 1992; Walsham, 2002). These perspectives provide explanations for the recursive and dynamic relationships between human agents (e.g., employees) and social structures (e.g., technology and business processes) and provide insights on how one influences the other

² Three basic perspectives have been employed to understand the impact of technology on individuals and organizations (see Black et al., 2004; Boudreau and Robey, 2005). First, the objectivist stance has taken an imperative or deterministic view of technology and proposed relatively static models of human behavior to study the influence of technology characteristics on human action or vice versa (e.g., 1989; Venkatesh, 2006; Venkatesh et al., 2003). Second, a subjective view has studied how the characteristics of "new technologies evolve as they are used and modified by people in the course of day-to-day activity" (Black et al., 2004, p. 573). Finally, suggesting that neither approach (i.e., objectivist or subjectivist) can provide a comprehensive account of the impact of technology on individuals and organizations, some have taken an integrative perspective that suggests that the causality runs in both directions: "technology influences the patterns of human activity, and the technology changes as it is modified in the course of day-to-day activity" (Black et al., 2004, p. 573). Drawing primarily on Giddens' (1984) structuration theory, this stream has focused on the social context surrounding technology, human agents, and organizations (e.g., Barrett and Walsham, 1999; Jones, 1997; Jones and Karsten, 2008; Majchrzak et al., 2000; Orlikowski, 2000; Orlikowski, 1993; Orlikowski, 1992; Pozzebon and Pinsonneault, 2005; Walsham, 2002).

³ See Appendix A for more about different theoretical perspectives.

through the process of appropriation and enactment. Giddens's (1984) structuration theory has been employed as an appropriate grounding and lens to study the interactions of human agents and various social systems, such as technology and organizations. It offers a solution to the dilemma of choosing between *agency and structure*, *subjective and objective*, and *micro and macro* conceptions of any phenomenon and allows researchers to embrace both (Giddens 1984). It posits that there is a reciprocal interaction of human agents and organizational *structure* or *structural properties*—a set of *rules* and *resources* that human agents produce or reproduce in their daily activities (Giddens, 1984; Orlikowski, 1992). It suggests that human actions are enabled and constrained by structural properties of social systems (e.g., organizations), and these structural properties are the result of previous actions by human agents (see Jones, 1997; Jones and Karsten, 2008; Pozzebon and Pinsonneault, 2005 for reviews). Human agents are purposeful, knowledgeable, reflexive and active, and have the ability to transform the structural properties of a social system (e.g., organization) by altering the rules or the distribution of resources (Giddens, 1984). Such actions will produce various (un)anticipated consequences that influence human agents' subsequent actions (Giddens, 1984).

Although the original structuration theory did not explicitly incorporate the notion of technology as a social system, subsequent research has done so (see Appendix B). Barley (1986) studied the changes in social interactions among human agents (e.g., radiologists, doctors) directly affected by the implementation of a new technology—CT scanner—in HCOs. His work was an important step in understanding the recursive interactions among human agents, technology, and institutional properties in HCOs. Subsequently, Orlikowski (1992) explained how human agents (e.g., technology designers, users, and decision makers), technology, and institutional properties (e.g., structural arrangements, business strategies, culture, control mechanisms, and standard operating procedures) influence each other. Following Giddens's notion of the duality of structure, Orlikowski (1992) proposed the duality of technology to capture the recursive relationship between human agents and technology, which was viewed as interpretively flexible—i.e., “there is flexibility in the design, use, and interpretation of technology” (p. 409).

UNDERSTANDING BUSINESS PROCESSES USING A STRUCTURATION FRAMEWORK

The structuration perspectives help us understand and explain the dynamic interplay among human agents, business processes, technology (e.g., ES), and institutional properties, and how this interplay unfolds over time in organizations in general and HCOs in particular. Figure 1 presents a graphical view of business processes' influence on human agents, technology, and institutional properties. Building on prior work (e.g., Orlikowski, 1992), it presents our position on the recursive relationships among business processes, technology, human agents and institutional properties in the healthcare setting. We argue that this reciprocal interaction between human agents and business processes can be independent of the interaction between human agents and technology. Further, we argue that business processes will have a recursive relationship with institutional properties in contrast to technology which is suggested in prior research to have a one-way influencing path with institutional properties (see Orlikowski, 1992)).

The thick lines in Figure 1 are the focus of this paper—how business processes related to SCM can influence and be influenced by human agents and institutional properties. The thin continuous lines represent structural model of technology as described in Orlikowski (1992). As those aspects of structuration theory are well-understood from prior research, we do not delve into those details. As noted earlier, in the context of ES (e.g., ERP), business processes and technology are tightly coupled via the dotted line between the two in the picture—we discuss this briefly here. In an ERP solution typically, the technology is designed to support specific business processes that are designed by the vendor as best practices and are fairly standardized across implementations of the particular vendor. Further, the technology and the business processes enable and/or constrain each other. For example, an ES may reduce complexity of a process by automating certain components of the process. In contrast, a business process that requires coordinated activities performed by different employees can increase the perceived complexity of an ES as employees may have to use some features of the system that are not easy to use (Venkatesh et al., 2003). This is particularly true for healthcare employees who have to coordinate with many internal and external stakeholders. Although this specific recursive relationship is important, this is not the focus of this research. Our primary focus is to understand the recursive relationships between business processes and human agents.

----- Insert Figure 1 about here -----

Notwithstanding the tight coupling between ES and business processes as discussed earlier, we suggest that human agents (i.e., healthcare employees) can assign different meanings to business processes (e.g., SCM processes) and ES and they may enact different aspects of process and system. For example, when organizations implement new business processes along with an ES, it is possible for employees to appropriate the system faithfully and resist the new process or vice versa. For example, in the context of an IT implementation in HCOs, Lapointe and Rivard (2005) found that healthcare employees developed different levels of resistance to the new technology and business processes. Malhotra et al. (2001) found that virtual team members exerted differential efforts to processes and technology in R&D projects. In the context of SCM, an employee may feel the need for a SCM system and may find the system useful in his or her job. However, he or she may be reluctant to process a customer order within 3 hours (assuming it is a business process requirement) because he or she may find it difficult (or unfair from a workload perspective) to process an order in such a short time. In this case, although the employee may develop favorable perceptions toward the ES as it is making his or her job easier in many respects, he or she may resist the new order management business process. This is a likely situation for most ES that supports cross-functional and IBPS that are standardized by vendors or industry consortia—e.g., RosettaNet (Bala and Venkatesh, 2007; Venkatesh and Bala, 2012). Bala (2013) studied SCM processes using the socio-technical systems (STS) theory and discussed how employees (i.e., human agents) develop perceptions of SCM process characteristics or structures. Therefore, our objective is to understand the recursive interactions of supply chain processes with human agents and institutional properties in a healthcare context.

Although an ES facilitates (or hinders) the execution of business processes, they are conceptually distinct. We explain this distinction from three different theoretical perspectives. First, the business process literature suggests that organizations may first design business processes (for existing processes, the design connotes design for innovation or improvement) and then implement an ES to automate/support these processes (e.g., Davenport, 1993; Smith and Fingar, 2003). This temporal separation suggests that business

processes even if they are enabled by an ES are conceptually distinct from the system.⁴ Second, prior research on work processes and organizational routines (e.g., Feldman, 2005; Malone et al., 1999; Pentland, 2003a, 2003b) has suggested that work processes may have various types of variations (e.g., improvisation, ad hoc combination, substitution, short-cuts, unexpected delays) depending on how human agents attempt to *expand*, *repair*, or *strive* these processes to achieve certain outcomes. Although prior research (e.g., Boudreau and Robey, 2005; Orlikowski, 2000; Orlikowski, 1992) has suggested that individuals appropriate the technology, such appropriation is usually at the feature level (Griffith, 1999; Jaspersen et al., 2005). Therefore, technology and business processes are distinct in terms of how human agents appropriate them and the implications of such appropriation (see also, Bala and Venkatesh, 2013). Finally, resource-based view suggests that a technology (e.g., an ERP system) may not be a unique resource for an organization, but a business process can be a unique resource or capability that may not be easily imitated (Ray et al., 2004). For example, many organizations can implement the same ERP (e.g., SAP) system but, as reported in much prior academic and trade press articles, these organizations may not achieve similar benefits (e.g., competitive advantage) because their business processes are different.

We suggest that there is a need to understand the unique relationship between business processes and human agents. Although prior work has incorporated business processes as a part of the structural features of organizations (e.g., rules), a type of institutional property (e.g., operating procedures), and an aspect of norms (e.g., rules that define the organizationally sanctioned way of executing a work), that research has not explicitly separated business processes from technology structures. Prior research (e.g., Ang et al., 1997; Bala and Venkatesh, 2013; Beaudry and Pinsonneault, 2005; Boudreau and Robey, 2005) provides examples of how human agents reacted toward various changes in their work methods (i.e., business processes) due to technology structures (e.g., complexity of the system). Both Ang et al. (1997) and Robey et al. (2002) discussed how users reacted differently to changes in business processes and implementation of

⁴ For example, a healthcare supplier may design a business process for order management and then find a system that supports this newly designed process. In this case, the system may not support all aspects of the newly designed process (i.e., sequence of activities by which an organization receives, processes, and fulfills customer orders) that may require some manual tasks or tasks supported by a different system. This suggests that a business process has distinct attributes (e.g., rules, resources, and constraints) beyond the systems that support the process.

ERP systems. As noted earlier, Lapointe and Rivard (2005) found that individuals resisted changes in the business processes over and above their resistance to the technology itself in three HCOs. This suggests that business processes are separable from the technology that supports them and human agents can influence, appropriate, and enact each differently. As noted earlier, although an employee may appropriate a technology faithfully, he or she may not execute a business process that he or she finds cognitively burdensome. Another reason for understanding the unique role of business processes over and above the technology that supports them is the emergence of IBPS in today's IT and business environments (see (Davenport 2005) for a discussion of process standardization). There have been several IBPS, advanced by organizational consortia—that have garnered great interest among researchers and practitioners alike—e.g., RosettaNet (Bala and Venkatesh, 2007; Gosain et al., 2004-2005, 2003; Malhotra et al., 2005; Venkatesh and Bala, 2007, 2012). With the sustained importance of understanding business process change for the past several years and the growth of process standards as a phenomenon, there is a need to separate business processes from technologies and to understand the interaction of business processes with the other components in the structuration theory framework.

There are a few reasons prior research on structuration theory will help in studying technology-driven business process changes (i.e., standardization) in organizations, especially in HCOs. First, like any other social system, a business process has rules and resources that constitute the structure of the process (see Feldman and Pentland, 2003). By definition, a business process consists of a sequence of activities that need to be accomplished in a specific way—i.e., rules (Davenport, 2000; Pentland, 2003a, 2003b). In addition, a business process requires certain resources (technology, people, and skills) for proper execution. Second, like technology, business processes have *duality* and are *interpretively flexible*. The duality of business processes is manifested in the following way: on the one hand, business processes are designed and executed by human agents in organizations; on the other hand, once institutionalized business processes can impose constraints on human agents interact with the processes. The flexibility in business processes is underscored in prior research that has suggested that even though a business process consists of a sequence of activities, these sequences are not necessarily structurally fixed (Feldman, 2005; Feldman and Pentland, 2003; Pentland,

2003a, 2003b). Pentland (2003a, p. 858) noted that business processes “are better conceptualized as generative structures that can produce a wide variety of different patterns or sequence of events.” Further, business processes consist of task sequences, with occasional variations, exceptions, and/or shortcuts, and there is typically opportunity for improvisation or ad-hoc combinations. Third, business processes and human agents can have a recursive relationship similar to the relationship between human agents and other social systems. Similar to the way human agents build certain interpretive schemes, facilities, and norms into technologies (Orlikowski, 1992), it is possible that they will build the same into business processes in their day-to-day execution of such processes.⁵

METHOD

We adopted an inductive exploratory approach to understand how business processes related to SCM play a role in the dynamics of human agents, technology, and institutional properties suggested in Figure 1.

Pozzebon and Pinsonneault (2005) suggested several methodological strategies for empirically applying structuration theory, such as the use of a grounded theory approach, provide a narrative, and develop visual mapping (e.g., graphically tracking and comparing sequence of interactions and actions), and temporal bracketing (e.g., temporal sequence of actions in organizations), for dealing with the duality of structure and interplay between the micro and macro. Our empirical approach is generally consistent with these strategies as we employed a grounded theory approach and used visual mappings and temporal bracketing to understand employees’ reactions to business process changes over time. Using a grounded theory approach (Strauss and Corbin 1998), we collected qualitative data using semi-structured interviews of employees of one organization that implemented a new SCM system and analytics tools along with a set of IBPS. Our approach was similar to prior exemplars of IT implementation research employing a grounded theory approach (e.g., Boudreau and Robey, 2005; Maznevski and Chudoba, 2000; Orlikowski, 1993). Following the tradition of this approach, we incorporated various theoretical perspectives from structuration theory that are pertinent to the ideas emerging from the data (Boudreau and Robey, 2005; Strauss and Corbin, 1998). Given the novelty of

⁵ For example, human agents involved in an interorganizational process (e.g., supply-chain process) will accumulate specific knowledge regarding the trading partners (i.e., *interpretive schemes*), utilize various interorganizational systems technologies (i.e., *facilities*), and follow a specific communication mode (i.e., *norms*) while executing the process.

the context (i.e., concurrent implementations of IBPS and an SCM system), a qualitative approach helped us develop rich insights on the context and employee reactions (Venkatesh et al., 2010, 2013, 2016).

Research Site

Our study site was a hardware manufacturer—HealthSup, Inc. (fictitious name)—that implemented a new supply chain module in its ERP system and RosettaNet-based IBPS—i.e., *partner interface processes (PIPs)* for SCM. HealthSup is a U.S.-based manufacturer that produces and supplies high-tech equipment for HCOs. Its customers include distributors of high-tech equipment and large HCOs in the U.S. and other countries. It had a fairly flat organizational structure with a large number of employees being engineers and designers of hardware circuitries. Based on the many visits of one of the authors to the organization, we gathered that the organization operated in a highly competitive environment and realized the need to constantly respond to changes in the market. Further, there was great pressure on the organization to meet customers' demands with very fast turnaround times. All these pressures pushed the organization to streamline its supply chain processes and other interorganizational business activities. The general organizational climate was geared toward innovation in products and market responsiveness.

Technology

Prior to the implementation of the new SCM system, HealthSup implemented an integrated ERP system to automate some of their internal business functions, such as finance and human resources. However, the top management realized that there were certain inefficiencies in their interorganizational business processes. As noted earlier, many HCOs do not have IT-enabled supply chain processes and HealthSup had to maintain different parallel processes to meet the requirements of each of its customers. For example, HealthSup's order management process included various modes of communication such as websites, fax, emails, telephone calls, and a proprietary electronic data interchange (EDI) system to support the need of different HCOs. The customers were able to order via any of these channels and HealthSup employees responded to customer inquiries using these different communication channels. Moreover, the transactions were handled through the EDI and legacy database systems. The processes were inefficient and the technology was not very responsive to the environmental demands. In order to make HealthSup's order management functions

more efficient and market-oriented, top management decided to implement an integrated SCM module in their ERP system along with RosettaNet-based IBPS to develop seamless supply chain business processes. The top management also decided to include analytics tools and capabilities offered by the vendor to capture high volume and variety of data (both from the SCM system and externally) and perform real-time analytics.

Supply Chain Business Processes

The supply chain module was implemented by an external IT solution provider who was affiliated with the ERP vendor. The RosettaNet partner interface processes (PIPs) were also implemented by the same IT solution provider. RosettaNet is an industry consortium of major technology-related and logistics organizations. It develops industry-wide, open business process standards (i.e., PIPs) for interorganizational relationships. Given that our purpose was to understand the interplay among business processes, technology, human agents, and institutional properties, studying an organization that had adopted RosettaNet-based IBPS provided an appropriate context to isolate the implementation of technology from the business processes. RosettaNet PIPs define business processes between trading partners by specifying the activities, decisions, and roles for each partner involved in a particular business activity (GS1 US, 2015). Each PIP includes a business document with the vocabulary and a business process with the choreography of the message dialog (GS1 US, 2015). A detailed description of PIPs is available at GS1 US (GS1 US, 2015). GS1 US, is a neutral, not-for-profit, international organization that develops and maintains standards for supply and demand chains across multiple sectors, supports the ongoing maintenance and implementation of the RosettaNet Standards through membership in the GS1 US Partner Connections Program (GS1 US, 2015). Appendix C presents an example PIP.

RosettaNet PIPs provide specifications for interorganizational or public business processes. Public business processes involve interactions with trading partners (e.g., exchange of business messages), whereas private business processes are internal to the organizations (e.g., interaction with internal back-end systems). It is important to note that standardization of these processes requires substantial changes to the internal private processes in order to respond to the needs of the trading partners' efficiently. Moreover, interorganizational processes are executed by employees from the respective trading partners. Therefore,

implementation of these processes will impact not only the interorganizational relationships, but also the employees responsible for the execution of the interorganizational and internal processes. In the case of HealthSup, implementation of the new process standards significantly altered the previous order management process—both public and private portions of the process. Employees who were responsible for managing HealthSup’s order management process were greatly affected by the implementation of both the new system and processes. Our focus was on the employees who went through this change.

During the time of our data collection, HealthSup implemented three PIPs to streamline its order management processes with its major distributors and customers. Because several of the other distributors as well as customers had already implemented some of these PIPs, HealthSup’s plan was to utilize these PIPs to improve the supply chain processes internally and for customer interactions. The specific PIPs are described in Table 1. These three PIPs were closely related as they were responsible for distinct aspects of HealthSup’s SCM function. Implementation of these PIPs required substantial changes to HealthSup’s overall SCM function. For example, HealthSup originally updated the order status on a specific web-based system designed for its customers and later transferred the data to its ERP system. HealthSup anticipated that it would be able to eliminate this redundant web-based system as the customers would have access to the order status information through the new PIPs. With the implementation of the new SCM module and RosettaNet-based IBPS, HealthSup was able to eliminate many redundant steps from its previous supply chain processes.

----- Insert Table 1 about here -----

Data Collection

We collected data from HealthSup over a period of 12 months. Our source company—the independent solution provider that implemented RosettaNet standards at HealthSup—allowed one of the authors to closely observe the implementation of the PIPs and interact with HealthSup employees who were directly affected by the changes. Before and during the implementation phase, the author spent extended periods of time in the business unit where the changes were being implemented. Therefore, we gained substantial knowledge regarding the old processes and system and understood how the new system and processes would alter HealthSup’s SCM. Immediately after the deployment of the IBPS (which took about 4 months after the

deployment of the SCM module), series of interviews of HealthSup employees who were responsible for executing various aspects of SCM were conducted. The employees interviewed were from multiple levels of the organizational hierarchy, with a few being responsible for operational work (e.g., receive and validate purchase orders), others were supervisors (e.g., approve purchase orders), and two were executives in the business unit. Several additional interviews were conducted over the next 8 months in order to understand employees continued interactions with the new system and business processes. In addition to the interviews, we collected project documents, organizational memos, and press releases related to supply chain module and RosettaNet PIPs implementations.

A total of 25 employees were interviewed over the 12-month period. We chose a small set of employees so we could interview them multiple times and develop a rapport with them over the course of the study. Getting to know the interviewees well was important to ensure their candor. On average, each employee was interviewed three times during our data collection. Interviews were semi-structured in nature with more open-ended questions in the early interviews to understand employees' general reactions toward the new system and processes, and lasted from 30 to 60 minutes. The interview script was consistent with Bala and Venkatesh (2007). The early interviews started with general questions regarding employees' interactions with the new system and processes, their general assessment, and evaluations of the system and processes. Subsequent questions were dictated by their early responses. The later interviews had more specific questions regarding the use of the new system, business processes, and changes in day-to-day activities.

Data Analysis

Following the guidelines of Strauss and Corbin (1998), we analyzed the data using three coding procedures: *open*, *axial*, and *selective*. *Open coding* is the process of breaking down, comparing, conceptualizing, and categorizing the qualitative data from the interview transcripts (Boudreau and Robey, 2005). The important step in open coding is to compare various incidents, events, quotes, and instances to find similarities and dissimilarities (Strauss and Corbin, 1998). We compared the responses from the interviews to identify similar text segments. We coded these similar text segments into meaningful categories. We used *axial coding* to further group these categories. This grouping was primarily based on the conceptual similarities of the

categories. Finally, selective coding, the process of integrating and refining the theory (Strauss and Corbin, 1998), was used to formulate a coherent story line from the findings (Boudreau and Robey, 2005). In selective coding, we integrated all the major categories identified in axial coding to form a *larger theoretical scheme*. We iterated between the theory and data and incorporated various ideas, concepts, and theoretical perspectives from prior literature to understand and explain employees' reactions. We continued the data analysis until *theoretical saturation*, the point at which diminishing returns are obtained from new data analysis or refinement of coding categories (Strauss and Corbin, 1998), was reached. We stopped the analysis when no new categories were emerging and new text segments could be placed into the existing codes and categories. In addition to analyzing the interview data, we reviewed internal corporate documents, memos, and press releases that we gathered during our data collection. This review provided greater insights on the context and helped us interpret and understand the interview data thoroughly.

RESULTS

In this section, we discuss how the interaction of human agents, business processes, and institutional properties unfolded over time. We conceptualize these temporal dynamics using the following three stages: *initiation*, *institutionalization*, and *routinization*. These stages are consistent with prior research on technology implementation in organizations (e.g., Cooper and Zmud, 1990, Orlikowski, 1992). These stages capture the temporal dynamics of the human agents' recursive relationships with technology and business processes.

Table 2 summarizes the key categories and subcategories across the stages.

----- Insert Table 2 about here -----

Initiation

The *initiation* stage began right after the deployment of the new system and RosettaNet PIPs. As we mentioned earlier, it took about 4 months for HealthSup to implement the PIPs after the implementation of the SCM module. During this time, HealthSup offered formal training to the employees who would be using the system and the accompanying business processes. The *training* was conducted by a contracted training provider appointed by the solution provider that implemented the SCM module and the RosettaNet PIPs. In addition to the formal training, the IT department offered documentation and tutorials to make the users

comfortable with the new system and business processes. Even though the IT department was particularly happy about the quality and breadth of the training, the reactions from the employees were mixed. Some employees were overwhelmed by the *complexity* of the new processes and technology. Each process required an understanding of the complex flow of activities and the orchestration of these activities. For example, for some activities within the new processes, employees had to respond within a certain timeframe. These restrictions added a significant burden on the employees. A few employees commented that due to the implementation of new processes, their job had transformed to “a whole new job” and the training was not adequate to perform their tasks. The training did not help improve individual and collective efficacy with respect to the new processes and technology. In sum, although some employees found the training to be helpful, others found the training to be inadequate.

“Training was very helpful. I needed it. Some others are better at learning things on the fly. That’s not me.”

“How can we do a whole new job with so little training?”

“I think the training is insufficient. Sure there are change management people around but they don’t know my job as well as I do. Not to mention, my job has changed.”

From a *learning* perspective, we found two alternative mindsets on the employees’ part: *exploration* and *exploitation*. Some employees were exploring the new technology (including the analytics tools and capabilities) and processes, whereas the others were reluctant to explore. We found that the employees who did not explore had limited themselves to a set of basic functionalities of the new system, i.e., only *exploitation*. Organizational learning and process management literatures suggest that both *exploration* and *exploitation* are important to achieve greater productivity (Benner and Tushman, 2002; March, 1999). We noticed that both groups of employees expressed certain interests in the new processes for different reasons. On the one hand, the employees who were involved in *exploration* were excited about the new processes as they believed that they would be able to discover new aspects of the processes that would enhance their job performance. On the other hand, the employees who were in favor of the routine aspects of the new processes believed that the new processes would reduce their “guess work.” They believed that the new process will reduce performance variations and increase efficiency.

“I am a dabbler. I have experimented with the technology quite a bit. I am coming to terms with how the process will flow and

am discovering that it's gonna be great."

"The new processes have many inefficiencies in my view. I find it better to pick and choose certain elements of the process. The rest I just ignore."

"It reduces the guess work and unnecessary thinking on my part. Now, I can focus on doing the [my] best."

As noted earlier, employees who were responsible for order management functions anticipated that their day-to-day activities were going to change. Some employees were under the impression that the new system and associated process changes would drastically alter the way they managed orders and interorganizational relationships. Although some users were looking forward to the changes, others were quite anxious. The primary characteristic of these initial reactions toward the process changes was *resistance*. We found that employees were unwilling to follow the steps in the new processes as they were reluctant to accept the changes—"I don't see any reason to change the way we did things." Given that the old system was still available, many employees were still using the old system. Other employees had started to use the new system, but were still following the old processes. This suggested that although employees were willing to accept the new system, they were reluctant to execute the new processes (e.g., Malhotra et al., 2001).

"For as long as I have been here, we have always done it the old way. I am having a hard time really following the new rules. They are so regimented."

"There are several aspects of the process that are easy to avoid. I use the system but I skip various steps in the other activities."

"I have a choice really. I can use the old system for many things still since we have both systems."

One of the key reasons for such strong resistance to the new processes was probably employees' perceptions about their *job changes* due to the new technology and processes (e.g., Bala and Venkatesh, 2013; Venkatesh et al., 2010). The work practices had changed significantly. Employees had to respond quickly which required the ability to make quick decisions, greater job responsibility, and autonomy. We found that although some employees had to acquire *new skills* to be able to follow the processes, some were concerned about the potential *deskilling*. Similarly, *job responsibility* and *autonomy* for some employees increased, although others anticipated a potential decrease.

"It is like having two jobs. One old job which helps me get stuff done. One new job with all the new flow, process, and technology. It's overwhelming."

"The expanded list of duties is good. I was starting to feel bored with my old job."

“I am not sure I can handle all the new things I have to do.”

We found that employees’ interactions with the new business processes were influenced by HealthSup’s institutional properties, such as *relational boundaries* (e.g., organizational structure, informational flow, and social interactions), *organizational culture* (e.g., innovativeness) of the unit responsible for SCM, and various *institutional pressures* (e.g., norms, relationship with external stakeholders). We noticed that employees were deeply concerned about the potential changes in the *organizational structure*. Although this change may not be a formal overhaul of the existing hierarchical structure (even though some employees anticipated such changes), it clearly represented a change in the decision making processes, degree of supervision, and more importantly, the information flow.

“Many redundant and bureaucratic steps are eliminated. Of course, I am sure we have added new ones. I suspect the org chart may look different. It should.”

“My job is different but so is the organization. I have told my wife that I have changed my job and my employer without changing my job and employer, if that makes any sense.”

“The people I have to talk to now are different. The information is coming from new places and it is new information. It is going to new places and it is also new type of information. I am at a loss.”

We found that employees’ perceptions regarding the existing *organizational culture* also influenced the way they acted upon the new processes. Some employees perceived that HealthSup was not very receptive to changes and, therefore, the changes associated with new processes might not work favorably in the long run. Other employees found the implementation of new processes to be risky but they thought the reward could potentially be high.

“Our organization is a large beast. I would be quite surprised if all these changes work in our case.”

“Our products are usually built on an element of high risk and high reward. I see our process changes here with all new technology to be quite the same.”

Although the top management of HealthSup was quite clear in terms of their intention to make the new technology and processes mandatory, some employees had the perception that the new processes were not really mandatory. Because of the perceived efficiency of the old processes, they were more inclined to follow the old processes using the new technology. As employees started to execute the new processes about four months after the deployment of the new system, some employees thought that the new processes were a

recommended, but not a required, way of managing orders. A few employees were even surprised that the management wanted them to abandon the old ways of communicating with the representatives of their major customers. Further, given that many external stakeholders (e.g., boundary spanners at HCOs and distributors) preferred the old manual processes (according to some HealthSup employees), these employees were concerned about whether the new processes would adversely affect their relationships with these external stakeholders. Because of all these reasons, the initiation stage was ridden with confusion in terms of new processes that affected the *relationship with external stakeholders*.

"I see the technology use as required. However, I see the process as quite a different thing. It is a recommendation."

"My rapport with our external stakeholders will deteriorate because we don't have to interact as much anymore."

Institutionalization

About two months following the implementation of new processes, the top management realized that, contrary to expectations and goals, the order management processes had become inefficient and problematic. Employee morale was low and the number of undesired incidents (e.g., miscommunication, failure to deliver the product on time) had increased. This prompted the top management to strictly enforce the use of the new technology and the processes. In an official memo circulated to all employees responsible for order management activities, the management called for a strict following of the new order management processes. We refer to this stage as *institutionalization* as the new technology and the processes were institutionalized (e.g., widespread adoption and use) during this stage.

Following the circulation of the memo, most employees started to use the new technology and follow the new processes more than they did before. Employees knew that technology use could be easily monitored, but the execution of processes could not as easily be monitored. Therefore, the employees used the new system, but attempted to *workaround* the processes (Bala and Venkatesh, 2016; Boudreau and Robey, 2005). For example, many employees were uncomfortable accepting a purchase order without getting verbal approval from their supervisors, even though supervisors' could approve a purchase order electronically in the new system. At the same time, some employees were exploring the new system and processes to find *short-cuts* so that they could avoid certain steps and directly input data into the system. Many employees

improvised and found alternative ways to accomplish the same objectives of the new processes.

“I have had some time to figure out how to circumvent some aspects of the process. It’s good and no one notices, which is better.”

“I expected there to be inefficiencies [in the process] and there are. I have found ways to get around the problems and now it’s all better and quicker.”

“I follow the process to the tee and then some. I have been able to find some ways to do things even more effectively. Give it time. So will others.”

During this stage, many employees learned various aspects of the technology and processes and became proficient in both. They discovered various ways to use features (e.g., various reports and predictive analytics) of the new system to improve their effectiveness. However, some employees were still struggling to master the system, new analytics tools, and processes. These employees were concerned about the rigidity of the process and blamed the process for their apparent inefficiency and inflexibility.

“I think there are so many new and good reports that are available on the system. I have started to find them and use them to improve my job performance. I hope it is noticed at review time.”

“I have mastered the ins and outs of my job now. I can do things quite well by following the structure.”

“I am still fairly clueless about the process. There have been so many changes and so many new things and touch points for my job.”

Now that the employees figured out their own ways of doing things using the system and processes, some employees discovered that their job had become more interesting and they have acquired some useful skills. In contrast, other employees were concerned that their job had become less important as they felt that their responsibility and autonomy had reduced.

“I have learned some new and marketable skills with being familiar with the business processes of [vendor]. I have also learned some new technologies.”

“I like my new job. I am doing new things.”

“I thought the job would get better. It has gotten worse, a lot worse.”

During this stage, the institutional properties were heavily influenced by employees’ interactions with the new processes. Given that the employees were forced to use the new processes, they had to stop interacting with many employees with whom they used to interact. However, they were also establishing new social networks as they started to interact with various other groups of people (e.g., IT support people). The employees who mastered the new processes and technology found that they had become somewhat central to

the social network as others had started to come to them to get help (e.g., Sykes, 2015; Sykes and Venkatesh, 2016; Sykes et al., 2014). Some employees noticed that unexpectedly the interaction with the boundary spanners from the customers had improved as both parties had a clear understanding of the status of a given order or shipment.

“The new processes have crippled my social circles.”

“I have gotten to know some new and powerful people in the org.”

“I think I understand the workflow and process better than most. So, I am able to help a lot of people now.”

“I think we are doing better by our external stakeholders with our new and improved processes.”

Routinization

With their ongoing interaction with the new technology and processes, the employees became very familiar with both. The technology and processes were no longer new to the employees and had become parts of the organizational work systems (Tyre and Orlikowski, 1994). We called this stage *routinization* that started approximately six months after the deployment of new processes. During this phase, some employees realized the improvement and expressed their commitment to the new order management processes. Some employees had started to explore the processes to accomplish objectives that were not originally intended. However, some employees noted that they were not able to explore the process due to feature constraints of the ES. From a learning perspective, many employees became experts on the new processes as they were attempting to use the system, analytics tools, and the processes for more integrative and emergent tasks (Cooper and Zmud, 1990).

“I was a skeptic. I have come around now. I think everything is working well. I like it.”

“I think the processes are great. The technology works well with the process most of the time. However, I don’t think we can innovate. It takes the ideas out of the hands of the people.”

Due to their mastery of the new processes and technology, we found that some employees felt that they became powerful. One key reason for this empowerment is their ability to exploit the system and processes to get accurate and timely information regarding the status of an order (Bala, 2013). At the same time, the employees felt that their jobs had finally transformed into something more meaningful. They felt a greater cognitive fit with the new system and processes. They developed a different sense of *task identity* as

they had a clear understanding of their task boundaries and job duties (Venkatesh et al., 2010).

“I like being as powerful as I am now because of the central role I occupy in the process and the information I have access to.”

“While I was a skeptic early, I like the fact that my job now has a much clearer delineation. I am not responsible for screw-ups before or after the work gets on my desk.”

“I have some skills now. Previously, I was pushing paper. Now, I have some [vendor] system experience. What I do now is much much better and far more important.”

From the perspective of institutional properties, the routinization stage was characterized by the emergence of new intraorganizational and interorganizational relationships and significant changes in the *organizational culture* in terms of customer orientation. As we found in the previous two stages, the *relational boundary* changed significantly due to the implementation of new processes. In the routinization phase, we found that the *relational separation* increased and employees became more independent, whereas the relationship and the degree of *coordination* with the external stakeholders had increased substantially.

“I am rather happy that I have greater wiggle room. I can do as I see fit.”

“I am disappointed that I don’t see many people that frequently. The social fabric has changed dramatically.”

“I think we coordinate better with our touch points on practically everything due to tighter ties and the time freed up for interactions exclusively with them.”

Organizational culture had become more customer-oriented but inflexible. Given that the ES coupled with the new processes and analytics capabilities made it possible to respond to customers’ needs quickly and effectively (e.g., accurate decision making due to real-time analytics capabilities), employees gradually became used to such responses. As the process standards diffused, the entire unit became more *outcome-oriented*. Supervisors were no longer recognizing subordinates’ successful execution of the processes. Over time, this led to the unit becoming *inflexible* and closed to innovation and improvement of processes. Also, employees were reluctant to work with customers who did not use RosettaNet standards.

“I have said all along, if we can serve customers better, I am game. After a year, I can unequivocally say that the answer is yes.”

“To me, it has boiled down to a simple tradeoff. Standardization or innovation. We have gone with standardization at the expense of potential for innovation. We have to do it one way, we are not going to be nimble and flexible.”

“It’s all about outcomes now. I mean, it is about the new process but the new process has so many metrics that it is really about outcomes.”

Figure 2 presents a process view of how employees act upon new business processes and technology

and how these actions unfold over a period of time. The figure shows that the human agents' enactment of business processes and technology (including analytics tools and capabilities) changes over time. Starting with strong resistance, the enactment reaches a point of mixed yet greater reinvention and commitment. However, this does not indicate a sign of stability as human agents continue their enactment through exploration. They appropriate the business processes by continuously creating and recreating the structural properties of business processes. At the same time, business processes mediate human agents' action by enabling or constraining their job. Further, human agents' enactment of business processes is influenced by institutional properties and at the same time influences various aspects of the institutional properties. In sum, our findings clearly suggest recursive relationships between technology-enabled (or constrained) business processes and human agents and institutional properties respectively. More discussion of human agents' enactment of business processes is provided in the next section.

----- Insert Figure 2 about here -----

DISCUSSION

Our objectives were to understand how employees react to changes in supply chain processes and how these reactions unfold over time. We studied process changes associated with RosettaNet-based IBPS and an ES module implementation at HealthSup Corporation—a healthcare equipment supplier. Our key finding was that employees reacted differentially toward business processes from technology (i.e., ES), suggesting that although employees may enact technology in accordance with the *spirit* of the technology, they may not enact a new business process faithfully or vice versa. We also found that employees attempted to improvise the new business processes (e.g., workarounds, short-cuts, avoidance). Although process variation is common in HCOs and other organizations (e.g., Pentland, 2003a, 2003b), we suggest that employees' enactment of business processes related to supply chain in various unanticipated ways may potentially result in unintended consequence with respect to the successful execution of healthcare supply chain processes.

Human Agency and Enactment of Processes and Analytics Capabilities

Our results illustrate that healthcare employees' enactment of supply chain business processes is different from that of the technology (i.e., ES and analytics tools and capabilities) that enables (or constrains) these

processes. Drawing on Giddens' (1984) structuration theory, we discussed a basic conjecture that business processes are social entities with structural properties (rules and resources) that are continuously produced or reproduced by the recursive interaction of human agents. We found this recursive interaction between HealthSup's employees and the new supply chain process standards. In particular, we found that human agents' enactment of these processes (re)created new aspects of work practices characterized by workarounds and improvisations in SCM activities. Such work practices enabled (and/or constrained) the employees by changing the meaning of their job. Prior research attributed misalignments between technology functionality and work processes as a source of workarounds (Markus and Tanis, 2000). However, we found that in a healthcare context, human agents were engaged in workarounds and improvisation (at least initially) even when the technology was closely supporting the processes, suggesting that healthcare employees have differential levels of resistance to business process changes and IT implementations. These findings are consistent with prior research on organizational routines (organizational routines are "repeated patterns of behavior that are bound by rules and customs and that do not change very much from one iteration to another" (Feldman, 2000, p. 622). It emphasized the role of agency and collective learning in explaining the situated changes in the routines (e.g., Feldman, 2000). Drawing on Feldman (2000) and Feldman and Pentland (2003, p. 105), we suggest that business processes have both ostensive (i.e., structural properties) and performance (i.e., agency) aspects, "with the performance creating and recreating the ostensive aspect and the ostensive aspect constraining and enabling the performances." Our results extend this theoretical perspective by studying complex IT-enabled business process changes.

From a temporal perspective, we found that initial resistance toward the process changes evolved over time as healthcare employees were continuously involved in various (re)creations of enactment of the new processes. Although the institutionalization phase was dominated by various workarounds and improvisation, the routinization was characterized as reinvention and continued commitment. This general pattern of enactment was consistent with prior technology implementation research (Beaudry and Pinsonneault, 2005; Boudreau and Robey, 2005; Lapointe and Rivard, 2005; Tyre and Orlikowski 1994). Yet, our findings were quite contrary in terms of how healthcare employees reacted to the new technology vs. the

new processes. More specifically, prior research suggested that users were reluctant to use the technology immediately after the deployment (e.g., Lapointe and Rivard, 2005; Sykes et al. 2011), whereas we found that employees were strongly opposed to the new processes, although not as opposed to the technology (including analytics tools and capabilities). We suggest that due to the complexity in the healthcare industry as discussed earlier, employees have a greater degree of resistance to new processes. Given that employees in this industry have to deal with different heterogeneous stakeholders and professional groups, and operate in an environment where mistakes and errors can be fatal, they are more likely to persist in routines that they have developed over time and have been successful. They, however, are receptive to the new analytics tools and capabilities because they believe these tools and capabilities can help them avoid mistakes and make effective decisions. The changes in enactment over time can be explained through Feldman's (2000) suggestion that human agents could alter the routines based on the outcomes of previous iterations. She suggested three responses to organizational routine changes: *repairing* the routine to produce the intended outcomes, *expanding* the routine to take advantage of the new possibilities, and *striving* to attain something that is difficult. We found that initially employees attempted to repair the processes, and with time, they attempted more striving and expanding (e.g., willingness to maximize benefits from the new analytics capabilities).

We noticed significant variations of enactment by different employees at different stages. For example, some employees were involved in exploration, whereas others were more exploitive when appropriating the new supply chain processes. This can be explained using the practice perspective suggested by Orlikowski (2000) who found that different groups of individuals enact a structure of practice differently depending on their role, job responsibility, experience, and other contextual factors. Moreover, Bourdieu's (1977) theory of practice suggested an improvisational nature of practice, indicating that practices are influenced by rules and expectations and a course of action within a given practice is to some extent novel no matter how constraining the situation is. HealthSup's employees were engaged in different enactment moves that were novel and distinct from each other. Thus, our results complement prior IT research employing practice and human agency perspectives (e.g., Boudreau and Robey, 2005; Orlikowski, 2000; Schultze and Orlikowski, 2004) by illustrating how the "notion of enactment" is different for business processes that are

enabled (or constrained) by technology (e.g., new systems and analytics capabilities).

Business Processes and Institutional Properties

Consistent with the idea that technology cannot directly change institutional properties (e.g., Orlikowski, 1992), we argue that business processes and associated analytics capabilities cannot causally influence institutional properties. It is the human actions on business processes and appropriations of new analytics capabilities that act on institutional properties and (re)create new structures for organizations. In the case of HealthSup, various enactments of business processes and analytics capabilities produced changes in relational boundaries and other institutional properties. With the human agents' continued interaction with business processes and associated changes in enactments, the structuration of institutional properties also changed. This is consistent with Orlikowski (1996) who suggested that, over a period of time, organizational change occurred through the ongoing, gradual, and reciprocal adjustments, accommodations, and improvisations enacted by the human agents on their work practices. Barley (1986, 1990) and Black et al. (2004) discussed how technology implementation influenced expertise and relational boundaries. We noticed similar patterns in social interactions and relational boundaries in HealthSup. Although human actions on business processes enact upon institutional properties, other aspects of institutional properties influence these actions. For example, employees' perceptions about the receptiveness to innovation and risk taking constrained their enactment of business processes and use of analytics tools and capabilities.

Theoretical Contributions

Our study makes several key contributions. First, we contribute to the research on SCM in healthcare by highlighting the importance of examining employees' reactions to supply chain process changes. As noted earlier, prior SCM work has primarily focused on organizational-level phenomena. Although there has been a vast body of work on supply chain designs, there is little or no work on how employees react to new supply chain processes, particularly in healthcare contexts. Our findings suggest that regardless of how efficient a supply chain process is, employees may not execute it faithfully if they feel that the process changes their jobs and routines. Even if a supply chain process is mandated, employees may find workarounds and shortcuts to bypass the steps in the process. Supply chain management research has seen substantial theoretical advances

in recent years (e.g., Ketchen Jr. and Hult, 2007; Miles and Snow, 2007). However, this research has traditionally overlooked employees' reactions to SCM practices and designs. We believe that there is a need to incorporate the relationships between human agents (e.g., employees) and supply chain processes, and between institutional properties and supply chain processes into theories of SCM to capture employees' reactions toward these processes. Healthcare is a unique context to understand these relationships due to the complex nature of this industry (Garman, 2006; Ramanujam and Rousseau, 2006). Further, given that supply chains are becoming more global and complex, examining these relationships will help researchers develop a holistic theoretical understanding of supply chain design and arrangements.

Second, we incorporated business processes in the complex dynamics suggested in the structural models of technology (e.g., Orlikowski, 1992). Although much prior research has incorporated the notion of business processes in technology or institutional properties, we argued that business processes, when enabled or constrained by an ES, are distinct social entities upon which human agents can enact different from how they enact the system. We found that human agents faithfully appropriated an ES but did not faithfully appropriate new processes as a part of their enactment. We thus extend prior research by providing a rich understanding of the agency perspective on technology-initiated business process changes. Our study revealed reciprocal interactions between business processes and human agents, and pointed to the changes in institutional properties resulting from human agents' actions on business processes. Further, we advance our understanding of how human agents recursively produce and reproduce structures in social entities (e.g., business processes) through their day-to-day activities.

Our research has three important implications for research on business processes. First, prior research in this area has primarily focused on process reengineering best practices. It does not provide a rich understanding of how process changes influence employees and how employees' execution of certain aspects of a process can change certain properties of an organization. We found that employees' jobs changed substantially from initiation to routinization with significant empowerment and job transformation occurring (or vice versa) as time elapsed. Thus, our research addresses the call for a wider view of complex technology implementation and business process reengineering that includes communication, people, and organizational

structure (Grover et al., 1995; Thong et al., 2000, 2003). Second, our study focused on the implementation of process standards in healthcare contexts. Implementation of process standards can be important drivers for improved productivity and quality, reduced errors, successful interorganizational relationships, and better coordination in the healthcare industry (Burns, 2002; Davenport, 2005; PricewaterhouseCoopers, 1999). In the context of software development, prior research has found that coding standards have a positive impact on coordination (e.g., Maruping et al. 2009). By studying healthcare employees' recursive interactions with process standards, we have provided additional theoretical depth in the area of process management. Similarly, this research offers important implications for organizational change literature (e.g., Van de Ven and Poole, 1995) by focusing on both micro (i.e., individual) and macro (organizational) aspects of process changes. It offers insights on managing organizational and technological changes in healthcare contexts. Finally, this research furthers our understanding of emergent structures of the norms, organizational structure, and formal and informal relationships in healthcare contexts. Although IT has been suggested as a driver for such emergent structures in HCOs, our results suggest that employees' actions on new business processes (re)produce such structures recursively. Thus, organizational theorists could incorporate IT-enabled business process changes in their view of new forms of organizational structure.

Practical Implications

RosettaNet PIPs represent best practices in interorganizational processes in the high-tech industry. Our research, however, suggests that implementation of best practice-based supply chain processes may not be well-received by employees in the healthcare industry because they may feel radical changes in their jobs and may not want to give up their existing routines and habits. In addition, they may feel changes in their relationships with their coworkers and external stakeholders. Our research suggests that managers responsible for implementing new supply chain design should be mindful about potential negative impact of process changes on employees. Given the recent call for IT-enabled process innovations in healthcare SCM (e.g., Brody, 2007; Long, 2005; Neumann, 2003), we suggest that careful consideration should be given by HCO managers when changing processes as employees may not faithfully execute new processes, thus resulting in inefficiencies and other unintended negative consequences. Compared to other organizations, this is a critical

issue for HCOs that represent pluralistic settings characterized by the presence of multiple powerful internal and external stakeholders (e.g., physicians, nurses, administrators, pharmacists, government agencies, insurance companies, accreditation agencies) with divergent and even competing objectives. Although we are not suggesting that HCOs should not consider implementing IT-enabled supply chain process standards to reduce process variations and improve operational efficiency, we are suggesting that HCO managers should be more mindful during the implementation about potential negative reactions by its stakeholders and develop interventions and change management strategies to minimize negative reactions. Examples of such interventions and change management strategies include: (1) gaining sponsorship and support from different stakeholder groups; (2) creating multidisciplinary implementation team with representatives from different stakeholder groups, particularly employees who will execute the new processes; (3) training for new processes; and (4) aligning and integrating new processes with internal processes (e.g., clinical and administrative processes) so that employees and other stakeholders develop a clear understanding of how new processes fit the overall business model (Bala and Venkatesh, 2013, 2016; Sykes and Venkatesh, 2016).

Recent research has suggested that the effectiveness of business processes is the appropriate gauge of organizational performance (Ray et al., 2004). It is thus important that HCOs carefully manage their business processes to achieve efficiency and effectiveness. Managing process change initiatives will be crucial for HCOs in the future (Sykes et al., 2011). Our findings suggest that employees may initially react to process standards negatively which may reduce efficiency. However, as time goes by, the negative outlook may disappear. Still, some employees will continue to find ways to avoid new processes. Therefore, managerial tracking of business processes is very important. Although tracking is difficult to implement, it is possible to adopt standards such as TQM or Six HealthSup to track process execution. Finally, our research provides practical implications for assimilation of complex technology (e.g., ES) research. Prior research has suggested the process misfit is responsible for numerous complex technology implementation failures in organizations in general and HCOs in particular (Bala and Venkatesh 2013; Barley, 1986; Lapointe and Rivard, 2005; Robey et al., 2002; Soh et al., 2000). Healthcare managers need to be more proactive in terms of assessing the implications of IT implementation from a process management perspective. In order to foster employees'

acceptance of process changes, managers need to develop interventions, such as training programs, tailored toward emphasizing the benefits associated with these changes (Sykes, 2015).

Limitations and Future Research

We studied only one organization, a manufacturer in the healthcare industry, with a few specific process changes associated with SCM. It is possible that the employees' reaction toward process changes will be significantly different in other HCOs and/or in other processes. In particular, employees may react differently to IBPS and SCM systems in a more traditional HCO, such as a hospital (e.g., Venkatesh et al., 2011).

Research is thus needed on how individuals react toward and interact with new processes and how organizational structure is (re)created by the implementation of new processes in different types of organizations, including HCOs. Also, process characteristics (inter- vs. intra-organizational, core vs. sub processes) play a key role in the complex dynamics, as shown in Figure 1. Work is needed to understand how different aspects of a process can influence employees and organizational structures differently.

This work focused on the intraorganizational aspects of process changes. Although the new processes implemented by HealthSup Corporation were interorganizational in nature, we did not study the trading partners of HealthSup to understand how their employees reacted toward the new processes. This limits the scope of our understanding. Therefore, future research should study the adoption and impacts of interorganizational process standards. Further, more research is needed to understand the process changes associated with different types of IT. For example, process changes associated with an ERP system could be considerably different from that of a CRM or SCM system. Furthermore, we only studied the employees of a particular unit of HealthSup. We believe that in order for us to understand the overall impacts of process changes, it is important to study other key stakeholders, such as top management, customers, suppliers or buyers (Rai et al. 2010; Setia et al. 2013). Therefore, future research should incorporate different stakeholders' perspectives to understand business process changes.

Another important future research direction would be to study different types of interventions that can potentially influence employees and other stakeholders to have favorable view toward process standards. Although prior research has suggested various interventions associated with IT adoption and use (e.g.,

Venkatesh and Bala, 2008), future research can examine interventions to foster adoption of new business processes or process changes in HCOs. We believe that carefully designed and orchestrated interventions can improve employees' reactions toward process changes. These interventions can help increase employees' trust in new business processes and technology. Finally, we did not study the outcomes of the deployment of new processes—this will be important next step because if the outcomes are not positive, it will be difficult to justify process standardization efforts, such as IBPS implementations (Rai et al. 2010).

CONCLUSIONS

Our objective was to understand employees' reactions to IBPS and a new SCM system implementation in healthcare contexts that enabled data analytics capabilities. We found that employees of a healthcare manufacturer differentially reacted toward new supply chain business processes, new SCM system, and data analytics capabilities. Our findings regarding the dynamic unfolding process of the relationship between human agents and material aspects of new technology structures (e.g., new system, processes, and analytics capabilities) provides a deeper understanding of how ES and new supply chain processes can transform workplaces by influencing employees' job and institutional properties. Our work provides insights into several areas that managers should consider and proactively manage as they embark on process standardization and analytics efforts. Finally, our most fundamental contribution is the understanding of how employees may react to new business processes by going beyond the extant research that primarily focuses on organizational level phenomena, rather than employees' reactions to process standardization.

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Table 1: PIPs Implemented by HealthSup

PIP	Description
PIP3A4: Request Purchase Order	The purpose of this PIP is to enable a buyer to issue a purchase order and obtain an immediate response from the supplier that acknowledges the status of the order (e.g., which of the purchase order product line items are accepted, rejected, or pending).
PIP3A6: Distribute Order Status	The purpose of this PIP is to enable a seller to send the status of a product order to a buyer. For example, a product line item may be backordered, shipped, or canceled. Order status is distributed when an open purchase order exists.
PIP3B2: Notify of Advance Shipment	This PIP allows a shipper to notify a receiver that a shipment has been assigned. This notification contains a detailed product level information about a shipment (e.g., when a shipment is expected to arrive).

Table 2: Key Findings

Influence		Initiation	Institutionalization	Routinization
Human agents and business processes	<i>Enactment</i>	<ul style="list-style-type: none"> - Resistance - Unwillingness to follow the new process - Avoidance - Shadow system - Process-technology compatibility 	<ul style="list-style-type: none"> - Workarounds - Short-cuts - Exploration - Improvisation 	<ul style="list-style-type: none"> - Reinvention - Commitment - Extended use - Integrative use - Emergent use
	<i>Job changes</i>	<ul style="list-style-type: none"> - New skills - Deskilling - Job responsibility - Autonomy - Reengineering 	<ul style="list-style-type: none"> - Task variety - Interdependence - Deskilling - Reskilling 	<ul style="list-style-type: none"> - Empowerment - Task identity - Job transformation
	<i>Learning</i>	<ul style="list-style-type: none"> - Training - Complexity - Exploration - Exploitation 	<ul style="list-style-type: none"> - Adaptability - Exploitation - Knowledge - Flexibility 	<ul style="list-style-type: none"> - Readaptability - Exploitation - Innovation - Expertise
Business processes and institutional properties	<i>Relational boundary</i>	<ul style="list-style-type: none"> - Changes in organizational structure - Information flow 	<ul style="list-style-type: none"> - Social interaction - Formal interaction - Trust 	<ul style="list-style-type: none"> - New social relationship - Independence - Relational separation
	<i>Org'l culture</i>	<ul style="list-style-type: none"> - Receptiveness to innovation - Risk taking - Resistance to change 	<ul style="list-style-type: none"> - Control - Innovation - Stability 	<ul style="list-style-type: none"> - Responsiveness - Inflexibility - Outcome orientation
	<i>Institutional pressure</i>	<ul style="list-style-type: none"> - Norms - Relationship with external stakeholders 	<ul style="list-style-type: none"> - Relationship with external stakeholders - Organizational mandate 	<ul style="list-style-type: none"> - New relationship with external stakeholders - Coordination

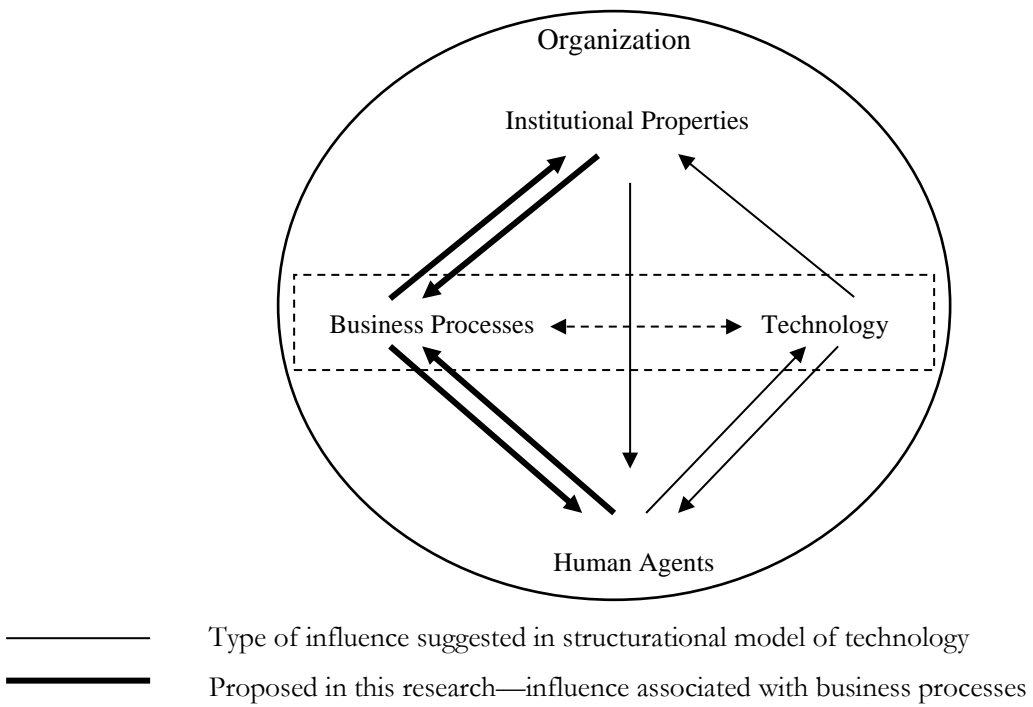


Figure 1: Business Process in the Structuration Framework

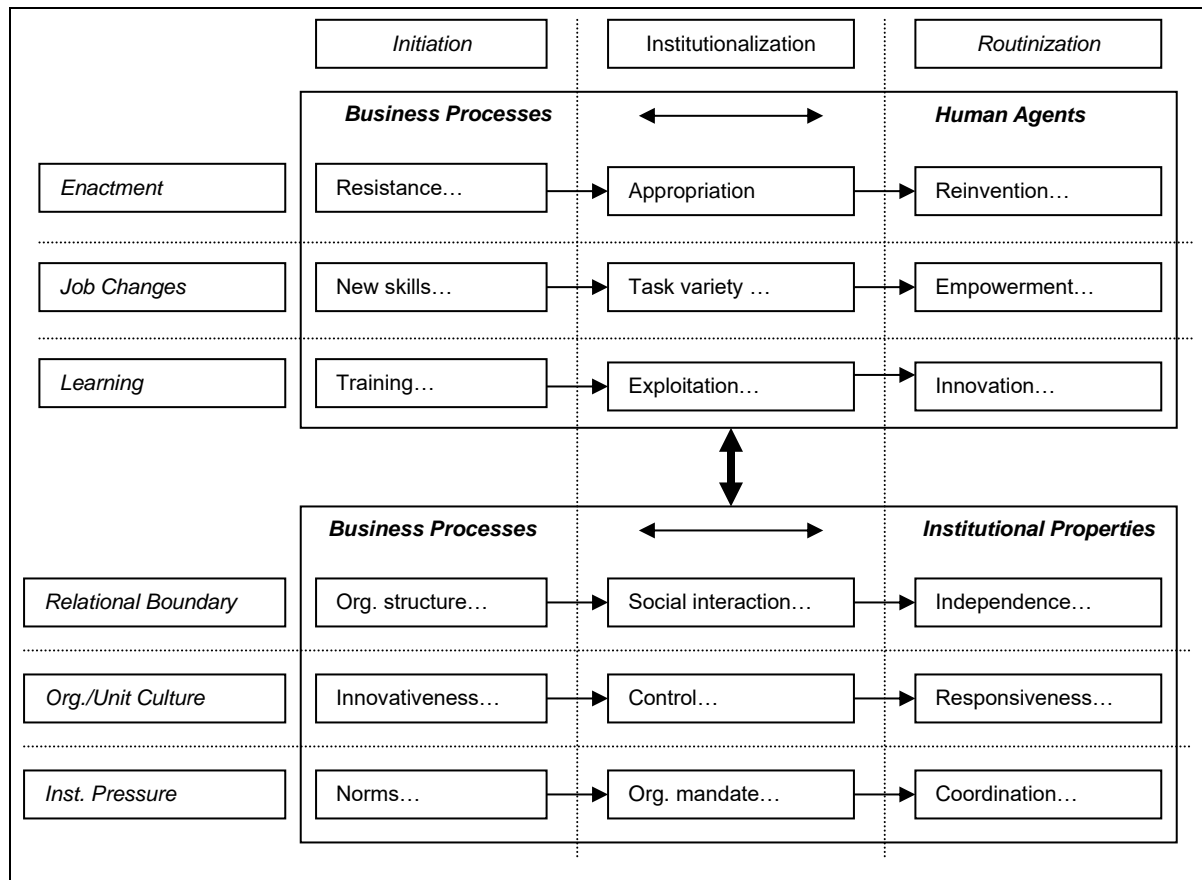


Figure 2: Interactions of Business Process, Human Agents, and Institutional Properties

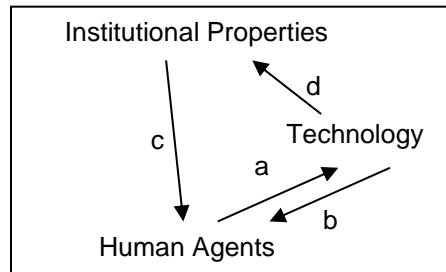
APPENDIX A

Theoretical Perspectives Related to Structuration Theory

Poole and DeSanctis (1990) and DeSanctis and Poole (1994) proposed the adaptive structuration theory (AST) that focused primarily on the structures *embedded* into technologies and how human agents interact with such structures. AST suggests that human agents *appropriate* the structure inscribed in technologies either *faithfully* or *unfaithfully* depending on the degree to which their use of technology corresponds to the structures embedded in a technology. Orlikowski (2000) suggested a *practice* perspective to understand technology in organizations emphasizing the *emergent* structures of technology as opposed to stable, predictable, or embedded structures. The perspective she advanced emphasizes *enactment* of as opposed to *appropriation* of technology. The essential thesis of this perspective is that human agents will enact a particular technology “in particular ways in particular conditions” (Orlikowski, 2000, p. 407) and continuously create and recreate the structural properties of the technology. The *human agency* perspective suggests that humans are relatively free to enact technologies in different ways (Boudreau and Robey, 2005; Emirbayer and Mische, 1998). Like the practice perspective, the human agency perspective posits that technology structures are not stable or embedded. Humans can use technology minimally, invoke it individually or collaboratively, and improvise in ways that produce novel and unanticipated consequences. This perspective posits against treating technology as a determinant of social change. Rather, technology is a vehicle of social change at the discretion of human agents.

APPENDIX B

Structurational Model of Technology

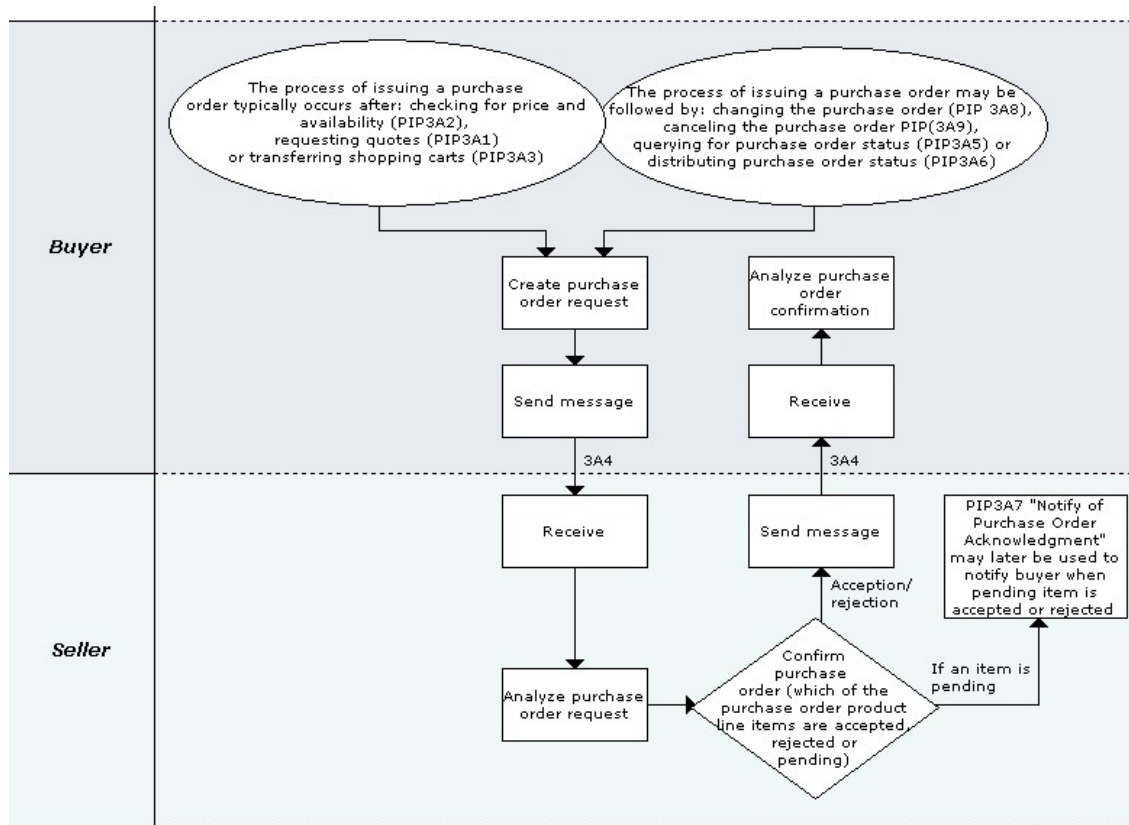


Note:

- 1) Human agents (e.g., developers, users) build into technologies certain structures (e.g., rules, resources) and appropriate technology by assigning shared meaning (*arrow a*).
- 2) Technology can mediate human agents' action by enabling or constraining their performance (*arrow b*).
- 3) Human agents are influenced by various institutional properties when they act (e.g., designing, appropriating, modifying, resisting) on technology (*arrow c*).
- 4) When human agents use technology, they can reinforce or transform institutional properties of an organization (*arrow d*).

APPENDIX C

RosettaNet Business Process Standard (PIP 3A4)



(PIP 3A4 – Request Purchase Order)

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