On the Design of IT Artifacts and the Emergence of Business Processes as Organizational Routines

Completed Research Paper

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Abstract

Much of the BPM literature views business process design and implementation as a top-down process that is built on strategic alignment and managerial control. This view is inconsistent with the observation that information infrastructures, including a company's business process infrastructure, are at drift, a term that refers to the lack of top-down management control. The paper contributes to resolving this inconsistency by developing a framework that conceptualizes business processes as emergent organizational routines that are represented, enabled, and constrained by IT artifacts. IT artifacts are developed in processes of functional-hierarchical decomposition and social design processes. Organizational routines have ostensive and performative aspects, forming a mutually constitutive duality. A literature review demonstrates that the propositions offered by the framework have been insufficiently considered in the BPM field. The paper concludes with an outlook to applying the framework to theorizing on the emergence of business processes on online social network sites.

Keywords: Business Process Management, Organizational Routine, Structuration Theory, Emergence, Design, Social Construction of Technology

Introduction

Business Process Management (BPM) has been conceptualized as a boundary-spanning research field that consolidates previous work on "how to best manage the (re-)design of individual business processes and how to develop a foundational Business Process Management capability in organizations catering for a variety of purposes and contexts" (vom Brocke and Rosemann 2010c, p. viii). Harmon (2010) traces the formation of the BPM field back to the research traditions of management, quality control, and information technology. Whereas the management tradition focuses on increasing overall firm performance, quality control targets work simplification and consistent quality of business processes, and information technology is concerned with automating work processes.

Given this long research tradition, it is surprising that BPM thought leaders recognize a lack of theory in this field. Melão and Pidd (2000, p. 111) argue that "there are few significant attempts to develop theoretical positions on possible approaches to BPM, possibly because the development of BPM has been driven by practitioners rather than by academics." Melão and Pidd (2000) find that much of the work in the BPM field tends to assume implicitly that business processes are deterministic machines that can be purposefully designed and implemented in the organization in a top-down process.

However, the view of business processes as deterministic contradicts Ciborra and Hanseth's (1995) observation that, particularly in the context of modernity (Giddens 1991), business process (and information) infrastructures are at drift, a term that refers to the lack of top-down management control. Therefore, BPM literature needs to acknowledge and theorize about the workings behind this drift and to integrate this view into the traditional contributions on designing business processes in top-down engineering processes.

This paper proposes a conceptual framework that takes a step toward developing this line of argument. The framework is built on two authoritative streams of research that have remained largely neglected in the BPM field. The first strand of work focuses on organizational routines, conceptualizing an organizational routine as "generative systems that produce repetitive, recognizable patterns of interdependent action carried out by multiple participants" (Pentland and Feldman 2008, p. 236). The second strand of literature views structure and agency as a mutually constitutive duality, based on structuration theory (Giddens 1984) and its IS successor theories (Jones and Karsten 2008), including adaptive structuration theory (DeSanctis and Poole 1994) and the practice lens account (Orlikowski 2000). The framework, which is inspired by the work of Pentland and Feldman (2008), identifies this duality for business processes as organizational routines and sets it in relation to the design of IT artifacts as subject to functional-hierarchical decomposition and social construction.

The framework contributes to establishing an understanding of the design of IT artifacts and the emergence of business processes in research and management that is ingrained in theory. In particular, two major theoretical insights on business processes are developed. First, inspired by the concept of drift, developers and managers cannot base the design of IT artifacts for business processes solely on a mechanistic engineering rationale but must ensure that the design is subject to a process of social design shaped by processes of sense-making and negotiation. Second, while IT artifacts enable and constrain business processes, processes emerge as social structures based on the agency of the users who perform their day-to-day work, thereby both intentionally and unintentionally shaping the company as a social institution. From the designer's point of view, the troubling consequence of the company's being a social institution is that performances of business processes be only partially shaped by designing IT artifacts like business process models, enterprise resource planning (ERP) systems, and standard operating procedures. Therefore, this paper argues for developing a more realistic approach toward the prospects and constraints of *design* in business processes management.

The remainder of this conceptual paper is organized as follows. Section 2 reviews the theoretical backgrounds of BPM research, organizational routines, and structuration theory. Section 3 presents results from a literature review in order to identify to what extent the theoretical concepts discussed have been addressed in the literature and to document to what degree the proposed theoretical view extends previous thinking. Section 4 presents the resulting framework, and Section 5 reflects the theoretical and managerial contributions the paper offers. Section 6 provides a research outlook on utilizing the framework as a device for analyzing the emergence of structure from business processes performed on online social network sites.

Theoretical Foundations

Business Process Management as a Multi-Disciplinary Research Field

Extending a first definition of processes "as essentially any sequence of work activities," the business process reengineering school conceptualizes a business process as "end-to-end work across an enterprise that creates customer value" (Hammer 2010, p. 4). BPM is a boundary-spanning research field that focuses on organization's foundational capabilities to manage their business processes (vom Brocke and Rosemann 2010c). Various topologies have been proposed for systematizing the areas that are core to BPM research, including a BPM framework (Rosemann and vom Brocke 2010), which includes as core factors strategic alignment, governance, methods, information technology, people, and culture.

Harmon (2010) traces the antecedents of the BPM field back to three research traditions: the management tradition of BPM research, which focuses on overall firm performance and the strategic alignment of business processes to organizational objectives; the quality or work-simplification tradition, which strives to improve the quality of business processes, traditionally in the production of physical goods; and the IT tradition, which uses computers and software applications to automate work processes.

These traditions tend to view business processes as being implemented in a top-down process that is aligned with business strategy, quality goals, or functional decomposition based on IT. In this spirit, Harmon (2010) discusses several layers of BPM—the enterprise level, the process level, and the implementation level—each of which details the superordinate layers. The business process reengineering approach as conceptualized by Hammer (2010) is likely based on creating a concept of a business process that is supposed to be instantiated and executed by the people in an organization. Against this backdrop, deviations from the engineered blueprint are seen as "faults" caused by inadequate training, insufficient resources, or faulty equipment that must be traced in root cause analyses and corrected by adapting the design of the conceptual business process. The vision behind this approach is to create "high-performance processes, which operate with much lower costs, faster speeds, greater accuracy, reduced assets, and enhanced flexibility" (Hammer 2010, p. 7). From the point of view of enterprise architecture, Rummler and Ramias (2010) identify business architecture, data architecture, application architecture, and technology architecture as a nested hierarchy of systems, a view that implies that engineers can design processes in a company consistently from top to bottom, since "any organization must adapt to its Super-System, or die" (Rummler and Ramias 2010, p. 85). This view results in the authors' proposing a value-creation hierarchy of five levels, comprised of an enterprise level, a value-creation level, a primary processing system level, process level, and a subprocess/task/subtask level, as a "top-to-bottom framework for organizational work" (Rummler and Ramias 2010, p. 85).

However, other BPM thought leaders question this view of business processes as subject to functional-hierarchical decomposition, while a satisfactory theoretical framework has not yet been developed. Davenport (2010) reviews process-oriented approaches for improving knowledge work, identifying four types of knowledge work based on the dimensions of work complexity and the level of actors' interdependence. Based on this framework, Davenport (2010) argues that routine work differs from highly improvisational work but offers no satisfactory theoretical explanation. Instead, general advice on how process managers can deal with the difference is provided, such as the advice to manage process improvements in as participatory an approach as possible.

Melão and Pidd (2000) identify four perspectives on business processes without resolving these perspectives in a framework. In the view of business processes as deterministic machines that is much reflected in the literature on business process reengineering, a business process "is a fixed sequence of well-defined activities or tasks performed by 'human machines' that convert inputs into outputs in order to accomplish clear objectives" (Melao and Pidd 2000, p. 112), consistent with Morgan's (1997) metaphor of a bureaucratic machine. This view emphasizes, among other points, that the structure of a business process can be designed for efficiency while neglecting human and organizational issues, and assumes that business processes are static (e.g., consistently carried out until their redesign is initiated) (Melao and Pidd 2000). In the view of business processes as complex dynamic systems, a business process dynamically adapts to a changing environment. Among other criticisms, this view is criticized for taking the "nature of the business process and of its actors" for granted and still treating humans as resources, for neglecting the costs of these complex approaches, and for ignoring the feedback loops that often

influence real-world business processes (Melao and Pidd 2000, p. 117). The view of business processes as a network of interacting feedback loops has been found to lack empirical evidence (Melao and Pidd 2000). The view of business processes as social constructs relaxes the assumption that a business process always follows clear objectives or is a predictable machine by seeing business processes as enactments by people such that changes in the process are a result of negotiating the conflicting interests of the stakeholders involved. However, this view does not address the role of technology and is criticized for its overemphasis on the human factor and for satisficing what is possible or negotiable in an organization while neglecting the achievements of business process modeling and optimization that might propose more objectively developed and more radical designs (Melao and Pidd 2000).

Business Process Infrastructures as Subject to Drift

Traditional management literature conceptualizes management control as an orderly, organized, top-down process, which is a fundamental principle of positivist thinking (Ciborra and Hanseth 1995). This view puts the centrality of measure and control center stage while defining technology "as a powerful set of tools augmenting human action and thinking" in a quest to "pull the messy everyday world towards an almost geometrical or mechanical view of the business organization" (Ciborra and Hanseth 1995, p. 5). In light of the arguments in the preceding section, much of the BPM literature is no exception in this regard.

Contrasting this view, Ciborra and Hanseth (1995) highlight that information infrastructures, including the business process infrastructure, are at *drift*, rendering top-down management control of companies inoperable. Based on the assumption that management is in control, managers develop business strategies that are influenced by a dynamic technological and organizational environment. With respect to BPM, Ciborra and Hanseth (1995) refer to market forces and to new software applications and technological innovations as environmental phenomena that impact business strategy. By means of strategic alignment, the organization strives to control these factors, leading to a need for more complex IT, processes, and standards. Whereas in an industrial vision strategic alignment refers to steering the company infrastructure by means of a top-down process based on business strategy, in Ciborra and Hanseth's (1995, p. 5) vision, "alignment is a long, tortuous, and fragile process whereby multiple actors and resources try to influence each other to constitute a new socio-technical order." Therefore, changing infrastructures, including an organization's business process infrastructure, is subject to resistance, deals, side effects, and the properties of the IT landscape. It follows that infrastructure is partially outside management control, and tends to *drift*, that is, an infrastructure deviates from its planned purpose for a variety of reasons outside anyone's influence, resulting in a perceived need for more control (Ciborra and Hanseth 1995).

In the context of *modernity* (Giddens 1991) and with the rise of globally distributed business process infrastructures and the performance of business processes on infrastructures that are outside the direct control of companies (such as online social network sites through which companies interact with networks of consumers), leading to "loosening-up of time-space constraints[,] the diffusion of systems that process information and knowledge[, and] the increasing pace of learning by economic and social institutions" (Ciborra and Hanseth 1995, p. 7), unintended side effects can travel faster and more forcefully, increasing unpredictability.

Social Structure and Agency as a Mutually Constitutive Duality

Business processes are social structures that are constructed and re-constructed by their performance in the day-to-day business of organizations. Therefore, structuration theory and its IS successor theories provide a theoretical lens into the constitution of business process infrastructures that are subject to drift.

(Social) Structure(s)

Structuration theory (Giddens 1984) conceptualizes social structure and human agency as a mutually constitutive duality while dropping the domination of structure over action that is often assumed in functionalism and naturalism and the domination of action over structure that is often assumed in hermeneutics and humanism. Although the "central concern of structuration theory is the relationship between individuals and society" (Jones and Karsten 2008, p. 129), Jones and Karsten (2008) identify a rich array of applications of structuration theory in IS research. In particular, they highlight the value of

structurational concepts as sensitizing devices in IS research, making structuration theory one of the most frequently used seminal theories in IS research (Jones and Karsten 2008).

In structuration theory, social structures are "rules and resources, or sets of transformation relations, organized as properties of social systems" (Giddens 1984, p. 25). Resources are identified as allocative resources, which command objects, goods, or material phenomena, and authoritative resources, which command persons and actors. Rules are "techniques or generalizable procedures applied in the enactment/reproduction of social practices" (Giddens 1984, p. 21), and formulated rules, such as bureaucratic rules, are codified interpretations of rules. Structuration refers to the "conditions governing the continuity or transmutation of structures, and therefore the reproduction of social systems" (Giddens 1984, p. 25).

Social systems are conceived as "reproduced social practices that do not 'have structures', but rather exhibit 'structural properties.'" Structure itself is a "virtual order of transformative relations [that] exists, as time-space presence, only in its instantiations in such practices and as memory traces orienting the conduct of knowledgeable human agents" (Giddens 1984, p. 17). Technology can influence social practice, depending on how social agents engage with it in their actions. Therefore, from the point of view of structuration theory, structure cannot be inscribed or embedded into technology (Jones and Karsten 2008). Structures "are not brought into being by social actors but continually recreated by them via the very means whereby they express themselves *as* actors" (Giddens 1984, p. 2). In other words, if all human agents were removed from a social system, all social structure would disappear with them.

The Duality of Structure

Structuration theory conceptualizes structure as "continuously produced and reproduced through situated practice" (Jones and Karsten 2008, p. 128). This "duality of structure" proposes that the "rules and resources drawn upon in the production and reproduction of social action are at the same time the means of system reproduction" (Giddens 1984, p. 19). In other words, structure always both constrains and enables human agents' actions, although structure itself is produced or re-produced only *through* human action (Giddens 1984, p. 25).

Agency and Power

Because of the reproduction of structure by actions, the assumption that individuals have the ability to transform social structures (Jones and Karsten 2008) is a central tenet of structuration theory. Giddens (1984, pp. 5-14) posits that all humans are knowledgeable agents who know much about how society works such that they can describe what they do and rationalize their actions. Power is conceived as the most central elemental concept in the social sciences since it is "the means of getting things done and, as such, directly implied in human action" (Giddens 1984, p. 283). Actors' power over resources enables actors to choose how they act, including complying with or changing social structure, resulting in a reproduction of social structure. In other words, human agents always have the power to "act otherwise" (Giddens 1984, p. 14).

Human intentionality denotes that the activities of human beings often follow plans and goals, even if these plans and goals cannot be explicitly formulated or humans are unaware of or unable to recognize their motivations (Jones and Karsten 2008; Nandhakumar et al. 2005). While "agency refers to doing" (Giddens 1984, p. 10), actions can have intended consequences as well as unintended consequences (Giddens 1984, pp. 10-11). Therefore, the production and reproduction of structure by human agents may have unintended consequences and might result in unacknowledged conditions that feed back into individuals' actions, leading to other, maybe undesirable, behavior (Giddens 1984, p. 5). These unintended consequences of actions might give rise to emergent properties of social structure (Archer 2010). Thus, the way in which social structure is created and re-created cannot be determined fully, but unfolds dynamically based on the intended and unintended consequences of the actions performed by individuals.

Social Structure and Routinization

Giddens 1984 (p. 60) points out that the concept of *routinization* is vital to the theory of structuration since it links the continuity of the agent's personality in his or her performance of day-to-day activities to

the institution of society. That is, in effect, social structure is sustained only if it is regularly reproduced. In addition, Giddens (1984) observes that a routine in day-to-day business "is psychologically linked to the minimizing of unconscious sources of anxiety," while "in the enactment of routines individuals sustain a sense of ontological security" (p. 282). Moreover, only routinization enables human actors to reflexively analyze actions that are "distinctively 'the same' across space and time"(Giddens 1984, p. 3). On a collective level, social systems are conceived as "reproduced relations between actors and collectivities, organized as regular social practices" (Giddens 1984, p.25), without which an institution would cease to exist.

Adaptations of Structuration Theory in the IS Discipline

Whereas structuration theory is focused on social structures and makes little reference to technology, adaptations to structuration theory, such as adaptive structuration theory (AST) (DeSanctis and Poole 1994) and the practice lens account (Orlikowski 2000) add an IS perspective to the debate (Jones and Karsten 2008).

AST argues that IT, work tasks, and the environment can be sources of structure and that the structures IT provides can be described in terms of the *structural features* (the properties of the IT artifact) and in terms of the *spirit of the feature set* (i.e., the use of an artifact in a way that its designers either intended or did not intend). In their agency, users are free to appropriate (or not appropriate) an IT artifact and might appropriate an IT artifact faithfully or unfaithfully (i.e., in a way consistent or inconsistent, respectively, with the spirit of the feature set). Interactions between users and the technology are assumed to be subject to the *dialectic of control*, in which either one is shaped by the other. The practice lens account is built on the premise that technology structures are *emergent* and cannot be embodied into the design, correcting Orlikowski's (1992) view of a duality of technology stated some years before (Jones and Karsten 2008). Jones and Karsten (2008) show that Giddens neglects how IT artifacts and human actions are interrelated and identify *affordances* (Gibson 1979) as one potential element of such an account. Affordances are the actionable properties between the world and an actor (Norman 2004; Jones and Karsten 2008). Thus, in line with Jones and Karsten (2008), technology is "not seen as determining action, but rather as defining a space for potential action" (p. 150).

Contrary to the symmetrical treatment of human actors and artificial actors proposed in Actor Network Theory (ANT) (Latour 2004), Nandhakumar et al. (2005) argue that intentionality sets human beings apart from artifacts (Giddens 1984). However, in line with Jones (1998), they acknowledge that *artifacts can exert agency* in their own right. In fact, that is the purpose of design, since designers "struggle to capture material agency in technology" (Nandhakumar et al. 2005, p. 224) in order to shape the potential space that enables and constrains its users' actions.

Organizational Routines' Ostensive and Performative Properties

Based on structuration theory, which highlights the importance of routinization for the individual and for the constitution of society and institutions, the theoretical concept of organizational routines that is discussed in organization science provides a lens through which to identify the forces that operate in the construction and reconstruction of structure in day-to-day business. In a seminal review, Becker (2004) traces the theoretical concept of *organizational routines* back to Nelson and Winters' (1982) work on economic change as evolution that builds on organizational routines as the central unit of analysis.

Becker's (2004) reflections on research focused on organizational routine state that an organizational routine has eight characteristics. First, organizational routines are *patterns* of actions, activities, behavior, or interactions that are carried out regularly in organizations. While actions and activities are frequently used synonymously, behavior is a response to a stimulus, and interaction is a subset of action that involves multiple actors, so it focuses on a collective level. A different understanding of routines conceptualizes them as cognitive regularities or cognitive patterns. The second characteristic of organizational routine is *recurrence* since one would not call a unique action a routine. Third, routines have a *collective* nature and involve multiple actors that are distributed across space or across the organization. A consequence of their dispersed nature is that routines can be carried out cooperatively by communities that have dispersed knowledge, perhaps leading to a local contextualization of the routine, resulting in its disruption.

The fourth characteristic of organizational routines is either *mindless action or effortful accomplishment*. In the former understanding, routines are carried out subconsciously without requiring attention. In the latter understanding, routines require effort, so that they are open to variation. In this regard, Feldman and Pentland (2003) content that organizational routines have both ostensive and performative aspects. Whereas the ostensive aspects are an ideal or schematic form of the routine, the performative aspects denote concrete actions carried out by individuals in specific places at specific times, so individuals choose how they carry out the routine. On a collective level the performance of the routine produces and reproduces its ostensive aspects. This view is a line with structuration theory (Giddens 1984), which advocates the duality of structure and agency.

Fifth, routines have a *processual character* in the sense that they are not stable but are subject to organizational and economic change. Becker (2004) identifies the *frequency of repetition*, the *regularity of the frequency* or its *interruptions*, and *time pressure* as particularly decisive factors in defining a routine. Time pressure increases the likelihood that routines will be maintained, whereas interruptions foster the desire to search for or adopt new routines. Since a routine is a structure that will emerge only if actions are carried out repetitively, regularity is an important factor. Sixth, routines are *context-dependent, embedded into organizations, and specific* to this context. Superior routines can be a source of sustainable competitive advantage since they cannot be easily transferred to or imitated by competitors. Therefore, there can be no universal best practices, at least as long as the context into which the routine is embedded differs. Seventh, routines are *path-dependent*, that is, they depend on their previous states, even though "change is part of the very nature of routines" (Becker 2004, p. 653) since every performance of the routine is an effortful accomplishment. Eighth, routines are *triggered* by actors, such as when they improve the efficiency of a routine, or by external cues, such as when a routine links to other routines.

Becker (2004) identifies six effects that organizational routines have on organizations. First, they coordinate actions by providing "regularity, unity, and systematicity" (Becker 2004, p. 654). In organizations, coordination fulfills the function of re-integrating knowledge that has been disaggregated due to a division of labor between the members of an organization, leading to a "segmentation of the institutional order" (Berger and Luckmann 1966, p. 82). Since they can include tacit knowledge, organizational routines coordinate activities in an organization without a need for "anyone to know anyone else's job" (Nelson and Winter 1982, p. 105, quoted from Grant 1996). Second, routines represent a "truce" (Becker 2004) between the actors involved with respect to cognitive and governance dimensions. Regarding the cognitive dimension, routines establish a "zone of indifference" in which the authority of actors is not consciously questioned, and regarding governance, even if a principal awards some bargaining power to an agent, it is seldom employed. Routines are interconnected by triggers so the routine can be coordinated. Third, the relative stability of organizational routines allows people to economize on their cognitive resources for information-processing and decision-making by focusing their attention on non-routine events while dealing with routine events semi-consciously. The fourth effect of routines on organizations is to reduce uncertainty by providing stability to organizational behavior. Fifth, the stability of routines depends on whether people feel that routines deliver satisfactory results, and they remain stable as long as it is more expensive to change the routine than to keep it in place. However, routines have also been viewed as a theoretical lens to study change in organizations (Feldman and Pentland 2003), since as social structures they do not exist without the agents (Giddens 1984) who might decide to change them any time. Sixth, routines are part of the organizational memory and can store tacit operational knowledge (Becker 2004), including knowledge on performing each of the activities the routine is comprised of, as well as knowledge on their coordination.

Reflections on the Body of Knowledge in BPM Research

In order to elicit the current status of BPM research in the IS discipline, a review of the literature in the top-tier journals was performed, excluding the *Journal of Information Technology* (*JIT*). A first screening for the term *business process* produced many papers that had only marginal connections to the topic, so a second search was performed for papers that contained the term *business process* either in their abstract or as a keyword. This search produced 106 papers, most of which were published in *JSIS* (30 papers) and *JMIS* (29). *ISR* (14), *EJIS* (11), *ISJ* (9), *MISQ* (8), and *JAIS* (5) produced fewer BPM-related papers, although *JSIS* and *JMIS* have the longest tradition of publishing BPM research among the top-tier journals.

The objective of the search was to determine to what extent the identified concepts are reflected in the BPM literature. The book chapters published in the *Handbook on Business Process Management* (vom Brocke and Rosemann 2010a, 2010b) which is a comprehensive and timely collection of papers, were included as well, so the sample of papers analyzed contained 106 journal papers and 53 book chapters.

The articles supplied some useful insights. For example, Giddens' work is referred to only in Willcocks and Smith (1995) and Nandhakumar et al. (2005), and adaptive structuration is referred to only in Nagasundaram and Bostrom (1994) and Srivardhana and Pawlowski (2007), and the reference in the latter is made only in the outlook section. Neither of the latter papers cites Giddens, too, or refers explicitly to the two main concepts of AST, that is, structural features and the spirit of the feature set. Emergence is referenced as a theoretical concept only in Nandhakumar et al. (2005) and in Shaw and Holland (2010), although the term is frequently used in its everyday meaning, to denote something that is proliferating. Drift is mentioned in six papers but is explored further only in Nandhakumar et al. (2005), which is also the only paper to discuss the duality of technology (a view that Orlikowski (2000) later revised) or affordances. Fifth, organizational routines were discussed explicitly in four papers, albeit the performative and ostensive properties of routines were not identified as interplaying to develop structure. Newell et al. (2000) and Boersma and Kingma (2005) were the only papers in the sample to refer to design, sense-making, and negotiation as important steps in the design and appropriation of technology, and although 148 studies include the term *design*, only 7 refer explicitly to the term *IT artifact/artefact*.

In order to outline how the identified constructs have been taken up in the literature, selected papers are reviewed here. (See Table 1 for an overview of the papers.)

In their in-depth case study on implementing ERP systems, Nandhakumar et al. (2005, p. 221) theoretically conceptualize "triggers and consequences of the cycles of control and drift." The study offers rich insights based on a strong theoretical foundation that includes drift, structuration theory, adaptive structuration theory, technological affordances, social structures, and ANT. Based on their observations derived in the case study, they identify cycles of control and drift in an ERP implementation process that result from cycles of designers' and users' intentional interactions, the affordances of the technical system, and the prevailing social structures in the company. However, the study of (Nandhakumar et al. 2005) is focused on the ERP implementation process without focusing on business processes explicitly or identifying connections to the literature on organizational routines and their ostensive and performative aspects.

Newell et al. (2000) develop a diffusion model for the spread of ideas and knowledge that underpin complex technologies (rather than the spread of IT artifacts), exemplified with business process re-engineering and packaged software. The model suggests that IT vendors design packaged software that conveys knowledge in a form that is difficult for users to unpack and integrate with organizational knowledge. Therefore, the designers and users are identified as disparate communities between which knowledge transfer is difficult to achieve. In line with the literature on the Social Construction of Technology (Weick 1976), Newell et al. (2000) emphasize that knowledge conveyed by and appropriated from technology must be incorporated into the user firm through a process of negotiation and sense-making (p. 254) by embedding it into the organization's existing routines and practices. This insightful study focuses on implementing knowledge that resides in IT artifacts into the organization. However, the study does not draw on structuration theory or its IT successor theories, it does not explain in detail how the interplay between the ostensive and performative aspects of changing the organizational routines takes place, and it provides no links to emergence or drift.

Boersma and Kingma's (2005) case study on restructuring an ERP system in a manufacturing company describes mutual shaping of technology and organization. The study shows that ERP implementation necessitates processes of design, sense-making, and negotiation and that ERP implementation is closely related to altering working routines in the company but does not refer to organizational routines and their ostensive and performative aspects. The authors highlight the mutually constitutive relationship between technology and organizations, but they do not explicitly base this view on structuration theory and its IS successor theories.

Sarker et al. (2006) use concepts from ANT to interpret the chain of events that led to business process change failure in an interpretive case study. They explain the effects of the role of IT, actors' interests, and the definitions of business process change techniques when the business processes were changed. Among

other effects, the authors highlight the importance of various negotiations in shaping the business process change initiative, but they do not explicitly define or base social structures on structuration theory or its IS successor theories.

Some studies discuss the identified concepts more remotely. Bala and Venkatesh (2007) and Wang et al. (2013) refer to organizational routines in their studies but refrain from investigating the interplay between these routines' ostensive and performative aspects in the process of structuration. Srivardhana and Pawlowski (2007) mention routines in their study on the relationships of ERP-related knowledge impacts and the absorptive capacity for business process innovation but do not apply (adaptive) structuration theory. Nagasundaram and Bostrom (1994) develop a framework for creative processes that is based on adaptive structuration theory and view creativity techniques as "providing a set of structures that enable, promote, or constrain certain kinds of group interaction and communication" (p. 100) that are appropriated by users or not, leading to emergent structuring mechanisms. While the understanding of structure as embodied in mechanisms is inconsistent with structuration theory, the article makes a rich account of the interplay between structures and their appropriations by human actors. However, no reference to organizational routines and their ostensive and performative aspects is drawn, and the paper does not focus on business processes.

In-depth inspections in other papers (Davern and Kauffman 2000; Lee et al. 2008; Mani et al. 2010; Pavlou and El Sawy 2006; Swanson 2010) focus on other phenomena than those on which the present search process focuses. Therefore, papers with fewer hits were not analyzed in detail.

Table 1. Related papers in top-tier journals with respect to the identified concepts	
Title	**Reference**
The dynamics of contextual forces of ERP implementation	Nandhakumar et al. (2005)
A knowledge-focused perspective on the diffusion and adoption of complex information technologies: the BPR example	Newell et al. (2000)
Understanding business process change failure: An actor-network perspective	Sarker et al. (2006)
An empirical analysis of the impact of information capabilities design on business process outsourcing performance	Mani et al. (2010)
Assimilation of interorganizational business process standards	Bala and Venkatesh (2007)
Examining the relational benefits of improved interfirm information processing capability in buyer-supplier dyads	Wang et al. (2013)
ERP systems as an enabler of sustained business process innovation: A knowledge-based view	Srivardhana and Pawlowski (2007)
From means to ends: The transformation of ERP in a manufacturing company	Boersma and Kingma (2005)
The structuring of creative processes using GSS: A framework for research	Nagasundaram and Bostrom (1994)
From IT leveraging competence to competitive advantage in turbulent environments: The case of new product development	Pavlou and El Sawy (2006)
Consultancies and capabilities in innovating with IT	Swanson (2010)
Process grammar as a tool for business process design	Lee et al. (2008)
Discovering potential and realizing value from information technology investments	Davern and Kauffman (2000)

Design of IT artifacts and emergence of business processes as organizational routines

This section organizes the theoretical foundations discussed in a conceptual framework of the design of IT artifacts for business processes and the emergence of the business process as an organizational routine. IT artifacts in the BPM field are proposed to be designed in efforts of social construction and engineering, whereas the ostensive aspects of a business process emerge as a social structure through the performances of the process. Putting these components together, one can visualize the interplay between the design of IT artifacts and the emergence of a business process as an organizational routine in the framework displayed in Figure 1. This framework is based on seminal work by Pentland and Feldman (2008). However, their framework contains no reference to the design of IT artifacts. This is why the framework needed to be extended in order to inform empirical studies on the interplay of the design of IT artifacts for business processes and the emergence of business processes as organizational routines. The components included in the proposed framework are described in the following sections.

Figure 1. Conceptualizing the interplay of the design of IT artifacts for business processes and the emergence of business processes as organizational routines, extending the framework proposed by Pentland and Feldman (2008)
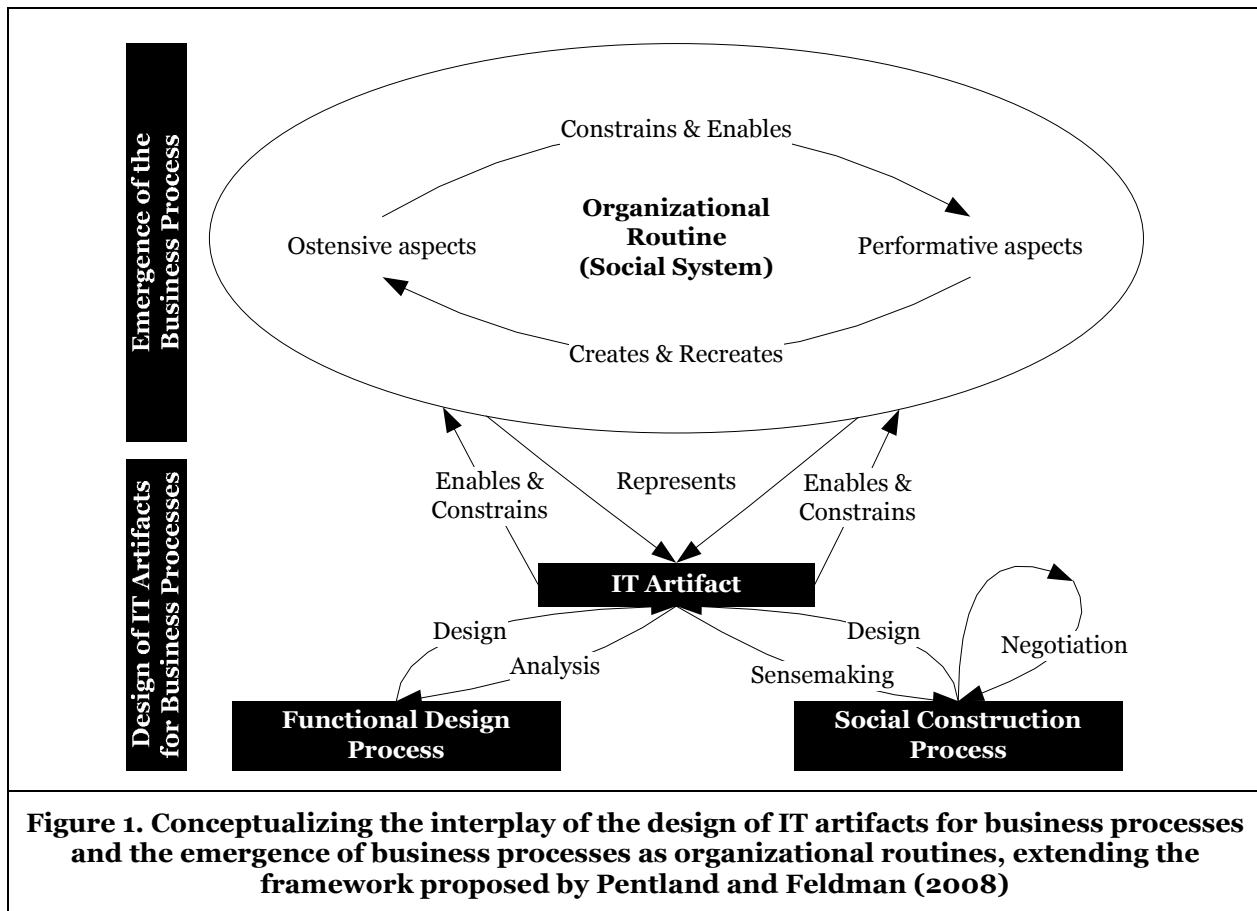
Business Processes Viewed as Organizational Routines

As a comparison of their properties (Table 2) implies, business processes can be viewed as organizational routines. This observation is important if the literature on organizational routines that originates from organization science were to be made accessible to the BPM field, and vice versa. Apart from few recent studies that explicitly refer to both strands of research (Breuker and Matzner 2013; Pentland et al. 2009), both fields seem to have been conducted in isolation from each other. Whereas literature in organization science offers rich insights into theory on organizational routines, BPM research has developed prospective IT artifacts for implementing and managing business processes based on IT. Therefore, networking both strands of literature more closely with each other seems to be an effort that promises rich additional insights for either side.

Table 2. A comparison of the properties of organizational routines and business processes	
Properties of organizational routines	**Selected properties of business processes**
Patterns of action	Business processes are patterns of actions that can be identified and modeled in business process models.
Recurrence	Business processes are analyzed and designed only if they are frequently performed so as to improve their efficiency.
Collective nature	Business processes are often carried out based on a division of labor between people or organizations in order to create value for customers.
Effortful accomplishments	Instances of business processes might deviate from each other and from their actual design on a type level. Their data traces can be analyzed and compared, such as by means of process mining techniques.
Processual character (in terms of change processes)	Business processes can change incrementally or as a result of disruptive business process re-engineering initiatives.
Context specificity	"Best practice" processes should be adapted to fit the particular needs and properties of organizational scenarios.
Path dependency	Business process changes should comply with the organizational and IT infrastructures onto which they are built.
Triggered by actors or by other routines	Business processes are started by human actors or by business processes which trigger events that are preconditions for other business processes.
Coordination of actions	Business processes coordinate the actions of multiple people working in multiple departments in an organization in an end-to-end fashion.
Stability of organizational behavior	Business processes are designed to be followed more than once, such as in mass transaction processing in ERP systems, leading to a consistent quality in business operations.
Resource efficiency and uncertainty reduction	Business processes are managed for resource efficiency, such as in benchmarking, provide reliability in business transactions, and serve as a common point of reference, reducing uncertainty.
Knowledge management	Process models codify knowledge about business processes so it can be stored in the organizational memory.

Business Processes as Subject to a Duality of Structure

From the observation that the notions of a business process and an organizational routine are compatible follows the notion that business processes can inherit the theoretical properties of organizational routines. This notion suggests that business processes feature both ostensive and performative aspects, just as organizational routines do (Feldman and Pentland 2003; Pentland and Feldman 2008). Consistent with Giddens' (1984) structuration theory, these two aspects are related in a mutually constitutive duality.

Common manifestations of the performative aspects of a business process are instantiations of workflows, such as the purchase-to-pay or order-to-cash processes administrated in ERP systems, and are reflected in the memory traces of the human actors who perform these processes. The ostensive aspects of a business process denote the ideal or schematic forms of the routine (Pentland and Feldman 2008) that enable and also constrain the enactments of the routine in the performance of knowledgeable human actors.

The interplay of the ostensive and performative aspects of a business process is subject to a duality of structure (Giddens 1984). On the one hand, the enactment of the ostensive aspects of a business process guide the performative aspects as templates, legitimate desired or de-legitimate undesired types of performances of business processes, and refer to sets of actions that could otherwise remain incomprehensible (Becker et al. 2013; Feldman and Pentland 2003). On the other hand, the performative aspects of a business process create and re-create the ostensive aspects as abstract patterns. In other words, the general idea behind a business process only comes into being based on its performances by individuals. Since the ostensive aspects of a routine are "the understandings (embodied as well as cognitive) of the participants" (Pentland and Feldman 2008, p. 241), there might be more than one ostensive aspect of a business process.

IT Artifacts as Representing, Enabling and Constraining Business Processes

In their article on the folly of designing artifacts while hoping for patterns of action, Pentland and Feldman (2008) propose that the ostensive and performative aspects of organizational routines—and, therefore, business processes—are closely related to (IT) artifacts. However, the authors emphasize that it is impossible to design the routines themselves, as designers can only design IT artifacts that *represent* (e.g., model) ostensive or performative aspects of a routine, whereas IT artifacts *influence* both aspects of the routines. IT artifacts do not *determine* how organizational routines will be performed or created. In this way, misunderstanding routines as "things" represents a strong form of technological determinism of the artifact on the routine and should be avoided (Pentland and Feldman 2008).

Pentland and Feldman's (2008) view is consistent with structuration theory in that it emphasizes that structure "cannot be *inscribed* or *embedded* in technology, since to do so would give it an existence separate from the practices of social actors," contradicting the duality of structure (Jones and Karsten 2008, p. 132). In addition, structure that resides in a material artifact is ontologically different from social structure that is created only in the practices of social actors (Jones and Karsten 2008). However, Giddens (1984, p. 177) recognizes that individuals' actions take place in the context of constraints raised by the human body and the material world, social sanctions by other agents, and structural constraints given by society *vis-à-vis* situated actors. These constraints limit the range of options an actor has available.

Arguably, the constraints of the human body and the material world are closely related to IT artifacts since the affordances of artifacts are designed to augment but might also constrain the range of opportunities of humans to act. Therefore, enacting the affordances might provide human actors with "power" over objects and other actors (Giddens 1984, p. 174-179) that they would not have had without using the artifacts, but enacting these affordances might also deny them power. Constructs, models, methods, and instantiations (March and Smith 1995) clearly fulfill these properties since they enable users to communicate with people outside the organization (e.g., by sending them invoices), but they also constrain these actions (e.g., by having to comply with the data structure of an invoice and with the business process that includes sending the invoice). Thus, IT artifacts might exert material agency (Jones 1998) by presenting affordances that human actors can decide to appropriate, whether faithfully or unfaithfully. These affordances enable and also constrain the performances of an organizational routine, just as do the ostensive aspects of the routine.

Conversely, as Pentland and Feldman (2008) note, IT artifacts can represent organizational routines. With respect to the performative aspect of organizational routines, these performances are frequently traced and documented in software. Therefore, insights contributed on process mining (van der Aalst and Weijters 2004; van der Aalst et al. 2003) and organizational mining (Song and van der Aalst 2008) in BPM research might be made applicable for identifying the performative aspects of organizational routines. Early work towards this end comprises the works of Pentland et al. (2009) and Breuker and Matzner (2013). With respect to the ostensive aspects, IT artifacts can represent how people think about

an organizational routine, apart from its performances in the day-to-day business. A case in point is business process re-engineering projects in which the "typical" control flow of a routine is modeled, analyzed, improved, and used for the design of other IT artifacts in order to present affordances for human actors to enact. Notably, representing either of the two aspects of a business process with an IT artifact is an incomplete mapping, since organizational routines can convey tacit knowledge (Becker 2004) that might be impossible to be codified with IT artifacts.

Designers design IT artifacts in order to foster the efficiency of business processes that are carried out based on appropriating their affordances. As noted in AST, the intentions of the designers and users are not necessarily compatible and may even contradict each other such that the business processes performed deviate from those envisioned by the designers of the IT artifacts. In addition, the performances of a business process necessarily result in both intended and unintended consequences such that the social structures produced and reproduced by these performances are not fully foreseeable, let alone designable.

IT Artifacts as Subject to Functional-Hierarchical Design and Social Construction of Technology

Since business process infrastructures are subject to drift, IT artifacts that enable business processes cannot be designed with respect only to their functional properties but must also reflect the properties of the social system in which the design takes place (Becker et al. 2013; Sein et al. 2011).

The design of IT artifacts is often conceptualized as a functional-hierarchical engineering process that is based on the principles of decomposition and modularity (Becker et al. 2013). A modular system is comprised of a set of modules that communicate with each other based on standardized interfaces (Langlois 2002). Such systems tend to be highly adaptable and require little coordination (Sanchez and Mahoney 1996; Weick 1976). In the context of IT artifacts for organizational routines, these engineering processes might be carried out based on analyzing the organizational routine to be supported, and designing an IT artifact to enable this or an adapted organizational routine.

Since organizational routines are collective patterns of actions, the design of IT artifacts for enabling and constraining organizational routines might also be understood as a process of social construction that is beyond the influence of individual designers (Becker et al. 2013). This view refers back to the concept of drift, referring to multiple actors with potentially conflicting interests that need to work together on designing IT artifacts that support an organizational routine. Social construction of technology (Bijker 1987; Howcroft et al. 2004) has been argued to include the key phases of design, sense-making, and negotiation (Lyytinen et al. 2008). Design refers to the development of IT artifacts, such as conducted in engineering processes based on functional design. Subsequently, other actors reason on the fit between the design and their own objectives. Since the views of different actors might be conflicting, negotiations could be necessary to resolve the conflicts, leading to a design that is acceptable for all actors involved in the design process.

Contribution

This paper offers managerial contributions and three contributions to theory on the design of IT artifacts and the emergence of business processes as organizational routines.

First, the paper motivates a departure from the assumption that business processes can be designed solely in processes of functional design based on decomposing process design into hierarchical levels that are aligned with corporate strategy. Although many BPM papers seem to make this assumption implicitly, it contradicts the observation that information infrastructures are at drift (Ciborra and Hanseth 1995), identifying the impossibility of complete control that is proliferating in the context of modernity (Giddens 1991). Since infrastructures are at drift, so are business process infrastructures.

Second, to remedy this conflict, this paper offers a conceptual framework with which to conceptualize the interplay between the design of IT artifacts and the emergence of business processes as organizational routines. The framework is based on two propositions: First, the design of IT artifacts for business processes cannot be performed solely in processes of functional decomposition (Becker et al. 2013; Sein et al. 2011), and IT artifacts are shaped by "messy" processes that are influenced by the social system in

which the design takes place. This claim is in line with literature that views the development of IT artifacts as cycles of design, sense-making, and negotiation (Lyytinen et al. 2008). The second proposition on which the framework is based is that providing IT artifacts that can be used to perform business processes cannot guarantee that users will appropriate these artifacts' affordances as intended; instead, users are free to decide for themselves how to perform business processes in their day-to-day work. This claim is in line with the literature on the interplay between organizational routines and artifacts (Pentland and Feldman 2008) and adaptive structuration theory (DeSanctis and Poole 1994). It follows that the (perceived) affordances of IT artifacts enable and constrain but do not determine the performances of business processes with their material agency. At the same time, the ostensive aspects of the business process also enable and constrain the performances of a business process. In turn, the performances of business processes create and recreate the ostensive aspects of the business process. This mutually constitutive relationship can be thought of in terms of a duality of structure that was first proposed in the structuration theory contributed by Giddens (1984).

Third, the paper provides an in-depth overview of the coverage of the identified theories in the BPM body of knowledge that has been published in the IS top-tier journals since 1988, 106 papers that include the search term *business process* in their abstracts or keywords. Among the journals, *JSIS* and *JMIS* offer the broadest forum for publishing BPM papers, but an in-depth review of papers from this sample and from the prospective book on BPM research (vom Brocke and Rosemann 2010a, 2010b) revealed that few BPM papers cover the theories discussed. The most comprehensive accounts are from Nandhakumar et al. (2005) and Newell et al. (2000), but while the former paper does not discuss how organizational routines elicit the inner workings of structuration in a business process context, the latter paper does not explicitly refer to structuration theory or its IS successor theories. The framework the present paper offers targets this gap in the literature.

The managerial contribution this paper offers is to remind business process managers that having well-designed IT artifacts, such as workflow management systems, ERP systems, business process models, and business process modeling tools, in place is no guarantee that business process performance will be high. IT artifacts can be used to perform business processes in the day-to-day work in companies, but they might not be used at all or be used in a way that is inconsistent with the designers' intentions. Performances of the routine shape the general ideas concerning "how we perform a business process in this organization" (the ostensive aspects of a business process). The bad news is that managers should not necessarily treat apparently low business process performance as deficiencies of IT artifacts that can be identified in root cause analyses, nor should they assume that business process re-engineering initiatives (leading to new IT artifacts) can resolve the problem. The good news is that human actors can adapt business processes and IT artifacts to perform business processes that differ from those the designers had in mind when developing the IT artifacts. Repetitively conducting business processes in different ways will result in the emergence of new organizational routines and lead to an evolution of organizations that is subject to an incremental bottom-up process.

Research Outlook

The proposed framework can serve as a frame of reference through which to explore the duality of business processes' structure in organizations, including the inner workings of the ostensive and performative aspects of business processes. It is proposed that the theoretical model introduced here is valid in multiple contexts, including business processes performed inside a company, in provider-customer interactions, in networks of companies, and on social media platforms.

A particular phenomenon that might be investigated empirically based on the framework is the interplay between the design of IT artifacts and the emergence of business processes as organizational routines in provider-customer interactions that are carried out on online social network sites (SNSs). Understanding and designing these interactions is a timely phenomenon warrants closer investigation in BPM research. Organizations use online SNSs like Facebook and LinkedIn to contact their clients where the clients are. Research has stated that some benefits companies realize to that end include open innovation for the goods and services a company offers, generating (positive) word of mouth, improving brand perception, making marketing initiatives more efficient, and collecting particular data on customers that would not be obtainable from traditional sales channels. Online SNSs are digital public goods that build on the principles of non-excludability, non-rivalry, versatility, and positive network effects (Rosemann et al.

2011). Since online SNSs are, by definition, based on the networked profiles of many individuals, drawing from Ciborra and Hanseth (1995), the effects of performing organizational routines publicly on online SNSs, whether they are intentional or unintentional, can be expected to travel quickly through the network and to have extensive reach. From the duality of structure, it follows that these effects are likely to speed up the production and reproduction of structure as well. Since companies are rarely in control of the underlying IT infrastructure of online SNSs, it seems likely that they have less power to influence the design and execution of business processes on SNSs than they do inside their own companies. Drawing from the vocabulary and insights offered by the proposed framework, further research might take one step closer to explaining, analyzing, and predicting these phenomena.

Acknowledgments

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