Routinizing Change: Does Business Process Management Technology Have Unintended Firm-Level Consequences?

Completed Research Paper

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Abstract

Business process management systems have demonstrated benefits at the process level, but evidence of firm level effects is inconclusive. We argue that as BPMS utilization grows, its use could become more routinized. Routinization tends to minimize search and can lead to competency traps. Furthermore, as more processes are managed within a BPMS framework, there will tend to be more shared modules and more shared information flows between the processes, making them more interdependent. This increased interdependence would tend to reduce flexibility for the organization as a whole. Ironically, our model predicts that the increased use of BPMS could increase firm-level inertia and reduce firm-level agility.

Keywords: Business process management, agility, routines, competency traps, inertia
Introduction

For firms that compete on the basis of their processes, new process development is a critical strategic objective (McAfee and Brynjolfsson 2008; Kim, Shin, Kim and Lee, 2011). Business process management systems (BPMS) are useful for this purpose because they enable firms to quickly assemble and reconfigure existing business processes. Rapid process reconfiguration is identified as a key strength of BPMS, because it can be used to enable organizational agility (Hoogland 2009; Merrifield et al. 2008; Wu and Park 2009; Cantara, 2011). Empirical studies are beginning to show that process-level dynamic capabilities can have a positive impact on firm performance (Kim et al, 2011). Thus, it seems natural to expect that increased utilization of BPMS should have significant firm-level benefits.

In this paper, we theorize about the unintended consequences that could occur when firms use BPMS to foster agility. We begin by observing that as utilization of BPMS within an organization grows, it will encompass more processes, and facilitate more frequent process changes. As a result, its use will tend to become more routinized. Unfortunately, routinization tends to minimize search (Becker, 2004; March and Simon, 1958; Nelson and Winter, 1982; Vilkas, 2011) and can lead to competency traps (March, 1991). Likewise, as more processes are managed within a BPMS framework, there will tend to be more shared modules and more shared information flows between the processes, making them more interdependent. Increased interdependence tends to reduce flexibility for the organization as a whole (Levinthal, 1997). Ironically, our model predicts that the increased use of BPMS could increase firm-level inertia and reduce agility. In focusing on unintended consequences, our goal is to open up a new stream of research on the firm-level effects of BPMS technology by providing a clear, concise theoretical argument, a research model and a set of propositions that will be testable in empirical research.

Theory

At the process level, research has demonstrated that BPMS has a variety of positive effects, as shown in Table 1, including efficiency, control, visibility and ease of revision. The question is whether these effects translate to the firm level. To analyze this question, it is important to clearly distinguish process level versus firm level and BPM practice versus BPM technology (BPMS).

<table>
<thead>
<tr>
<th>Table 1: Process level effects of BPM</th>
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<tr>
<td>Increased efficiency</td>
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<td>Increased control and conformance</td>
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<td>Increase process visibility (e.g., through customized dashboards)</td>
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<td>Make process parameters and rules readily available for edit and revision</td>
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In this paper, process level refers to particular business processes, such as customer support, order-to-cash, or purchase-to-pay. Within a firm, there are many such processes, especially since a firm may have multiple divisions or sub-units, each of which may potentially have different processes. By firm level, we refer to the complete collection of these processes.

Second, it is important to distinguish between generic process management practices, such as total quality management (TQM) or ISO9000 (Benner and Tushman, 2003) and the kind of technology-based business process management systems on which we focus here. This is a mature commercial sector (Cantera et al, 2011), with established competitors, such as the ARIS framework (Scheer, 1998, 1999), which includes a “warehouse” of business process models and a “factory” for combining them (Kirchmer, 2004).
Our inquiry is motivated, in part, by the observation that generic BPM practices such as TQM and ISO9000 have never been shown to have firm-level benefits (Benner and Tushman, 2003). The newest, technologically-enabled process management techniques are clearly effective at the process level, but will the demonstrated benefits at the process level aggregate to the firm level?

**The BPM cycle: Model-Assemble-Deploy-Monitor**

To address this question, we base our analysis on the core BPM process that Ferguson and Stockton (2006) call the Model-Assemble-Deploy-Monitor cycle (M-A-D-M). They argue that BPMS allows firms to carry out this basic cycle as often as desired to re-design and re-deploy the repertoire of processes in the firm. The cycle has four stages, as follows.

- **Modeling.** The M-A-D-M cycle begins with formal modeling, which uses precise semantics that can facilitate process assembly. In modern BPM software, process modeling can include templates that facilitate rapid design and redesign of a process. Naturally, templates can be modified to incorporate specific business requirements. The outcome of this stage is a set of formally-defined processes and their components.

- **Assembling.** In the M-A-D-M cycle, processes are “assembled,” rather than built from scratch (Sun, Kumar and Yen, 2006). This terminology reflects the significant overlap between business process management and technologies that support process modularization and standardization, such as service-oriented architecture (SOA) (Cherbakov et al. 2005; Leymann et al. 2002; Zhao and Cheng 2005). For example, a system for valuing properties could be used in multiple processes, and is probably outsourced from a third-party vendor (Wu and Park 2009).

- **Deploying.** Once a process is assembled, it can be deployed in various ways. For example, BPM software suites provide tools for generating software, or for executing the process directly through a BPM “engine.” By deploying the process in this way, it promotes conformance with the process model. As McAfee and Brynjolfsson (2008) note, the ability to replicate a process precisely in many locations can be a valuable source of competitive advantage, because it enables innovations to be quickly diffused across an organization’s branches.

- **Monitoring.** BPM software can also be used to construct a dashboard for monitoring the key performance indicators (KPIs) of the process, once it is up and running. This allows managers to check performance, as well as conformance, in real time, across an entire organization. Ferguson and Stockton (2006) note that KPIs should be an explicit part of a well-specified process model.

The M-A-D-M cycle is conceptualized as covering the whole lifecycle of a process, including planning, design, implementation, operations, and optimization (Papazoglou and van den Heuvel 2007; Weske et al. 2004). In the following sections, we consider some potential side-effects that could occur as this cycle becomes more widely used and routinized within an organization.

**Unintended consequences of routinizing change**

BPMS is an expensive, relatively mature technology, with many firms offering commercial products (Dixon and Jones 2011). When firms make this investment, they naturally want to see significant utilization. Scheer and Klueckmann (2009) argue that ideally, an organization should include many processes in the BPM framework. As more processes are actively managed, it is natural to expect that the M-A-D-M cycle will be carried out more frequently, in rough proportion to the number of processes being managed. Figure 1 shows a set of causal relationships that can be predicted to follow from increased BPMS utilization. The rationale for these relationships is discussed below.
Utilization leads to routinization

Organizations investing in BPMS technology will want to increase utilization. This means including more processes in the BPMS framework. BPMS vendors emphasize the advantage of reconfiguring processes as often as necessary to meet business needs. In this respect, BPMS seems to fulfill Grover’s (1999) observation that business process reengineering was evolving beyond one-time projects towards a notion of continuous change.

In addition, there are a variety of organizational initiatives that involve changes to business processes, including TQM, BPR, Six Sigma, CRM, SCM, and the implementation of ERP systems. Such programs often have different philosophical and functional origins, organizational sponsors, and stated primary goals. They may even be perceived as competing projects championed by different groups within the same organization (Huq and Martin, 2006). Yet they are likely to require similar set of skills and technologies and may involve analyzing and changing same or inter-related business processes (Koch, 2001). To the extent that such initiatives are engaged, it will encourage more frequent process change.

Frequent repetition

As a result of more frequent repetition, we can expect some degree of routinization (March and Simon, 1958; Vilkas, 2011) in the use of the BPMS. While not as repetitive as typical transactions, design processes and methods clearly involve recognizable patterns of interdependent actions among multiple participants, qualities that define organizational routines (Feldman and Pentland 2003).

Standard operating procedures

It is also likely that the BPMS investment will be accompanied by attention to an appropriate process change methodology, such as ISO 9000 (Ould, 1990) or Six Sigma (Harmon, 2007), which will include guidance on how to carry out the process management cycle in the context of the specific software and the governance structure of the specific organization. In effect, adopting a particular BPMS technology means adopting a standard operating procedure (“SOP”) for the change process. As they learn and gain experience with this method, they will become faster and more efficient. Rather than debating how to go about redesigning a process, they will follow the procedure.

Technological enablement and constraint

Repetitive performance of an SOP inevitably leads to some degree of routinization, but doing so in a context that is enabled and constrained by technological artifacts is likely to accelerate and deepen the process (D’Adderio, 2011). As Leonard (2011) argues, routines and technology are deeply intertwined.
(“imbricated”) in practice. Each BPMS software platform includes specific tools and techniques for modeling, assembling, deploying and monitoring processes. While these tools may be selectively appropriated by users, they will tend to shape and constrain the way process management is carried out.

By creating more occasions for performing the M-A-D-M cycle, and supplying the organization with procedures and artifacts that enable and constrain their actions, BPMS will tend to routinize the process management cycle. Over time, as the organization gains experience in carrying out various parts of this procedure, it will inevitably become more routinized. This leads to our first proposition:

**Proposition 1:** As BPMS utilization increases, the M-A-D-M cycle will become more routinized.

**Routineing leads to competency traps**

Routineing has important benefits; it improves efficiency by reducing the need for search (Eisenhardt, Furr, and Bingham, 2010; March and Simon, 1958), reducing cognitive load, and minimizing organizational conflict (Nelson and Winter, 1982). However, routinization can also lead to the formation of "competency traps" (March 1991). Competency traps occur when organizations become skilled at carrying out a particular routine. Because they excel at that routine, they find it difficult to change, even when external conditions dictate that change would be beneficial (Simsek, 2009). This kind of inertia is a result of the path dependent nature of routines (Schulz 2008). Competency traps are one of the key reasons that routines cause inertia in organizations (Aldrich, 1999).

When the routine in question is a change process, like M-A-D-M, “inertia” can look more like “momentum.” Amburgey, Kelly and Barnett (1993) offer an insightful and eloquent explanation that is worth quoting at some length:

“Over time, organizations develop not only operating routines but also "modification routines": procedures for changing and creating operating routines (Nelson and Winter, 1982: 17). Typically, modification routines govern the process through which organizations search for solutions to new problems (Levitt and March, 1988: 321), To routinize the process of change, however, an organization must gain experience in modifying operating routines. In short, organizations learn to change by changing.

....

The more experience an organization has with a particular type of change, the more likely that the change will be seen as a solution to a broader and broader set of problems. Unless the environment of the organization is unusually placid, a steady stream of problems requiring solutions will be forthcoming. Moreover, the increased competence in making a particular type of change lowers the marginal cost of making the change. Because the cost decreases, changes that offer a lower level of prospective benefits are more attractive and more likely to be carried out. Whether or not these changes actually solve problems can be irrelevant.” (p.54)

BPMS fits this theoretical story quite well. It lowers the cost of making certain kinds of changes, relative to others. This leads to our second proposition:

**Proposition 2:** Routinized use of BPMS will lead to competency traps.

In the worst cases, as Amburgey et al (1993) argue, it may lead organization to make changes that are most readily “do-able” regardless of their effectiveness or appropriateness for the problem at hand. This is the hallmark of a competency trap: following a course of action or procedure because it is familiar or relatively inexpensive. One might argue that the automated tools provided in BPMS make it possible to do a more thorough and extensive job than would otherwise be possible, so even if an organization becomes “trapped” into a particular approach to the M-A-D-M cycle, it would still be more effective than any alternative. Unfortunately, the effects of routinization may undermine this idealized story, as well.

**Routineing tends to minimize search**

As a process becomes more routine, it usually becomes more efficient. The gains in efficiency come from minimizing search (Becker, 2004; March and Simon 1958) and organizational conflict (Nelson and
Winter 1982). While this is clearly desirable for operational routines (e.g., transaction processing), these qualities may be less than ideal for a creative activity like process design. This is because design can be characterized as search within a design space (MacLean, Young, Bellotti and Moran, 1991; Simon 1969), and the design space for business processes is enormous (Lee et al. 2008). It seems counter-intuitive to suggest that design can be improved by routinization, which tends to minimize search.

Routinization also involves minimizing conflict through the creation of “truces” between process participants with different interests (Nelson and Winter 1982; Zbaracki and Bergen 2010), so that opposing views and conflict are suppressed. Once again, that does not seem like a recipe for a good design process, since process design typically requires a thorough consideration of alternatives that concern different stakeholders. Research has shown that modest levels of conflict (so-called “healthy conflict”) can improve outcomes in group decision-making (Janis 1982; Jehn 1995). Hammer (2007, p.113) has observed that the tendency to minimize search and conflict may be a limiting factor in the success of process management: “Although process redesign is no longer the terra incognita it once was, one issue stubbornly persists: Most companies tend to overlay new processes on already established functional organizations.” This leads us to another proposition:

**Proposition 3:** Routinized use of BPMS facilitates superficial process changes that conform to existing organizational structures and politics.

**BPMS utilization may increase process interdependence**

The potential side-effects of BPMS on process interdependence is separate from the effects of routinization. As more processes get moved onto a BPMS framework, and subject to frequent M-A-D-M cycles, how will the interdependence between the processes be affected? When there are multiple processes, with multiple points of potential interaction, it is difficult to think clearly about interdependence because the problem is combinatoric and dependencies between processes can be difficult to detect (Malone et al. 1999). The question here is whether the process level benefits can be scaled up by adding more processes: is BPMS scalable?

A simple thought experiment can demonstrate the relationship between interdependence and scalability. Consider the case of regular television broadcasting. One transmitter can support any number of receivers. Each additional channel requires one additional transmitter. There is no interdependence between the receivers, and the system is quite readily scalable. Up to the limit of available bandwidth, and the power of the transmitters, you can simply add more. In terms of complexity theory, the fitness landscape of this system is smooth and single peaked (Kauffman 1993; Levinthal and Warglien 1999). This system can support any number of simultaneous viewers, tuned to whichever channel they please.

Now imagine that, for some reason, the TV receivers are interdependent. Imagine that the ability of each TV set to tune in one station depends on how some unknown number of other TV sets are tuned at that moment (or how they have been tuned recently). What will happen if you add more TV sets? Or more transmitters? It’s hard to say without knowing the precise pattern of interdependencies. But it is clear that as the number of interdependencies increases, the possibility of every viewer tuning in to the station they want when they want it, will necessarily decrease. In terms of complexity theory, the fitness landscape of this system is “rugged” (Kauffman1993; Levinthal and Warglien 1999).

Because they are interdependent, business processes are more like the imaginary TV sets than real ones. Worse yet, the individual TV sets (business processes) have inertia and they tend to drift (Ciborra 2000) – they cannot be quickly retuned and they do not stay tuned. So, when one process is tuned, its performance might drop off because some other process is being re-tuned, or simply drifting. A tragic example of this “practical drift”, Snook’s (2002) term for the steady uncoupling of practice from procedure, was the shooting down of two US Army helicopters by friendly forces.

**Shared information flows.** One strategy for improving coordination between processes is to add an information flow. For example, the Electronic Data Interchange (EDI) protocol includes an Advance Shipping Notice (ASN) that informs a customer when to expect a shipment. This extra flow of information helps improve coordination in just-in-time supply chain networks. Through monitoring, BPMS helps organizations identify the need for improved coordination, as well as model, assemble and deploy a new process. To improve coordination, the new process will require additional information.
flows, which increases interdependence because the definition, format, timing, and availability of each shared information flow must be coordinated.

**Shared process components.** BPMS encourages the re-use of process components (Smith and Fingar, 2003), and the advent of Web services technology has provided added momentum to this feature, because software components can be dynamically invoked to support business processes (van den Heuvel and Maamar, 2003; Zhang, 2005). One reason to bring more processes into a BPMS framework is to capitalize on this opportunity. While component re-use helps minimize certain kinds of costs, it has a side-effect in terms of process interdependence. When processes share components, they become more interdependent. When different technologies co-exist in an organizational routine, they not only coordinate interdependent activities, but also alter the existing level of task interdependence and create technology interdependence (Bailey et al. 2010). As a result, nowadays interdependence among people is complemented by interdependence among technologies (Bailey et al. 2010).

Shared process components and information flows leads to our next proposition:

**Proposition 4:** Increased utilization of BPMS leads to increased interdependence among processes.

**Does BPMS lead to organizational inertia?**

If we follow the logic of this argument to its conclusion, we arrive at a counter-intuitive result: a technology that fosters efficiency and flexibility at the process level may tend to foster inertia and lack of flexibility at the organizational level. Organizational inertia is present when the speed of change in the core features of an organization is lower than the rate of environmental change (Hannan & Freeman, 1984). Each of the side effects of BPMS that we have identified (competency traps, limited search and increased interdependence) are directly associated with organizational inertia and an increased risk of organizational failure, especially in turbulent environments (Benner & Tushman, 2003; Levinthal, 1997). Ironically, organizations that invest in BPMS and maximize its utilization in order to boost their agility may be getting the opposite result.

**Discussion**

At the level of each process being managed, BPMS is clearly a powerful and effective tool. BPMS promises the possibility of fast, easy and frequent process change. As more processes are managed in a common framework, the M-A-D-M cycle will be used more frequently. While increased use should be an indicator of successful BPMS implementation, it could have some unexpected side effects, as outlined in propositions 1 through 4.

These propositions are empirically testable; these side effects may not occur in every BPMS implementation. And even if they do occur, they would not necessarily eliminate the aggregate value of BPMS in process level efficiency improvement. However, they do suggest that achieving firm-level benefits of BPM might be more difficult than simply aggregating the process level benefits.

**Process interdependence**

Increased interdependence is classic inhibitor of change (Kauffman 1993; Levinthal 1997); the more tightly interconnected a system is, the less easily it can adapt or change. Tightly coupled organizations are subject to high rates of failure in changing environments (Levinthal 1997). Even when the environment is stable, systems have become so complex that predicting where problems will occur is a challenge, and “accidents” have become almost “normal” (Perrow, 1984).

Ironically, while BPMS is believed to encourage increased agility, it may tend to have the opposite effect. Further, there is a potential here for a self-reinforcing cycle. As interdependence grows, and large changes become more difficult, the emphasis on incremental change an optimization may become more pronounced. Fine-tuning a process may require sharing information or components from other processes -- building more connections and increasing the interdependence. Increased interdependence leads to an increased reliance on local process optimization, which tends to promote further interdependence.

As Rettig (2007) notes, modular technologies like SOA and BPMS cannot eliminate the complexity and interdependencies that exist in an actual business. After all, the modules and services within a business
process need to work together, sharing data as well as physical inputs and outputs and other kinds of resources. Like the other drawbacks of routinization (competency traps and reduced search), process interdependence is an inherent result of assembling larger numbers of processes from the same set of components.

**Can good governance help?**

Maturity models such as the Business Process Maturity Model (BPMM) (OMG, 2008) and the Process and Enterprise Maturity Model (PEMM) (Hammer, 2007) specify various aspects of process management maturity, such as planning, leadership, measurement, resource and skills. These models focus on establishing accountability and guiding action through the establishment of structures and procedures both at the process and firm level so as to achieve strategic alignment (Bandara et al., 2007; Indulska, et al., 2009; Rosemann, de Bruin & Power, 2006).

The propositions offered in this paper suggest that appropriate goal setting and governance of the process management process itself (the M-A-D-M cycle) will be a key ingredient in attaining the potential benefits of BPM, while avoiding the pitfalls. Some contexts, such as supply chain management, may not be amenable to being controlled with BPMS, because the inertia it leads to may not be a good fit for the emergent and adaptive nature of the processes that operate there (Choi, Dooley & Rungtusanatham, 2001). Furthermore, some organizations may choose to deploy BPMS technology for reasons other than agility, such as process integrity or optimization (Cantera et al., 2011).

Since this is basically a process management problem, perhaps we can apply BPM concepts. For example, can we envision a Process Management Dashboard that allows managers to monitor the M-A-D-M process to ensure that corporate objectives are being met? The first challenge in creating such a dashboard would be to identify the key performance indicators (KPIs) that should be measured and displayed. Identifying appropriate KPIs for M-A-D-M would not be easy. One must deal with the classic problem of rewarding A while hoping for B (Kerr 1975). BPM is supposed to make the change process faster and easier, which seems to imply that Speed and Ease would be sensible KPIs. But if we put “Speed” and “Ease” on the Process Design Dashboard, there is some risk that process designers might focus on whatever they can do most Quickly and Easily. A separate challenge is that while the feedback from these dashboards and the incentives embedded in them may motivate individuals, little is known about the development of feedback systems for influencing interdependent individuals (Greve 2008).

There is also the question of who should choose the KPIs and the weights allocated to each of them. The diverse set of participants involved in the process management process means that accountability will be diffused across many individuals for these decisions as well as others, such as deciding how frequently process change should take place. Participants will have to balance the benefits and risks that their units will face from these decisions and compare them against the overall organization’s perspective. They may not have the same goals as each other, which could make the BPM process a negotiated, dialectic one (Van de Ven and Poole 1995) following a logic of opposition (Robey and Boudreau 1999). Of course, that would make the process considerably less routine.

The material properties of processes also influence the outcomes. Processes which are more amenable to being automated could become more central in BPM planning, enhancing the role of their participants. Hence, governing the M-A-D-M cycle becomes a sociomaterial practice (Leonardi and Barley 2008; Orlikowski 2007), with the attributes of the processes influencing the role that BPMS plays in an organization, partly by changing its political balance.

Whatever specific KPIs are selected, the goal would be use BPM in a manner that is consistent with the strategic objectives of the organization (Cantara et al., 2011). This might involve building new capabilities or enhancing and refining existing capabilities, or some combination. They key thing is that BPMS can be used for either objective, and that these objectives can be, at least to some extent, incompatible. BPMS can be an engine for change or an engine for inertia, and appropriate governance will likely be an important factor in deciding which.
Limitations
We have focused on potential negative side-effects. It may be that there are positive side-effects as well, depending on the goals of the organization. For example, organizational inertia can be valuable in some situations because it stabilizes organizational structures and patterns of activity, making organizations more reliable and accountable (Kelly and Amburgey, 1991; O’Reilly and Tushman, 2004). And as Cantara et al (2011) point out, some organizations may choose to implement BPMS with the goal of enhancing process stability and efficiency. If agility is not an organizational objective, then the issues raised here might not be problematic.

Conclusion
We have argued that while BPMS are clearly beneficial at the level of individual processes, their value at the firm-level cannot be taken for granted. Simply assuming that process-level effects will percolate up to the level of the overall firm is an example of the fallacy of composition: individual processes in an organization may become more efficient when BPMS are applied, but this does not imply that the entire organization will become more efficient when BPMS are used across all processes. Ironically, the mechanism that defines process agility in theory—frequent process redesign—might actually inhibit agility in practice, due to routinization of the change process itself. Over time, as more processes are virtualized (Overby, 2008) and become more dependent on technology, and more organizations operate in environments that require a high level of reliability, bad habits can creep into even the best organizations (Weick, Sutcliffe and Obstfeld, 1999). In the case of BPMS, vigilance is crucial for preventing the cumulative inertia brought on by process-level improvements.

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