Building a Complementary Agenda for Business Process Management and Digital Innovation

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Abstract

The world is blazing with change and digital innovation is fueling the fire. Process management can help channel the heat into useful work. Unfortunately, research on digital innovation and process management has been conducted by separate communities operating under orthogonal assumptions. We argue that a synthesis of assumptions is required to bring these streams of research together. We offer suggestions for how these assumptions can be updated to facilitate a convergent conversation between the two research streams. We also suggest ways that methodologies from each stream could benefit the other. Together with the three exemplar empirical studies included in the special issue on business process management and digital innovation, we develop a broader foundation for reinventing research on business process management in a world ablaze with digital innovation.

Keywords: Business process management, digital innovation, organizational routines, process-aware information systems, theory

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[1] Author order seems alphabetical, but was actually determined by comparing hair length, thickness and volume. The exact algorithm is confidential.

Introduction

We live in a digital world. From toothbrushes, thermostats, and telephones to cars, buildings and airplanes, the objects we use at work and in everyday life are augmented with digital capabilities that infuse their substance and meaning (Baskerville, Myers, & Yoo, 2020). As Floridi (2012) put it, our physical world and the objects in it are being "enveloped" by a digital layer building on pervasive and accessible digital infrastructure of computers, broadband networks and mobile devices (Brynjolfsson & McAfee, 2014; Fichman, Dos Santos, & Zheng, 2014). Digital platform businesses dominate our economy (Tiwana, 2015). Innovative digital devices feature in the experiences of more and more people (Yoo, 2010) through the proliferation of smart, connected products, online social networks, and wearable devices (e.g., Benbunan-Fich, 2019; Beverungen, Müller, Matzner, Mendling, & vom Brocke, 2019; Gerlach & Centefelli, 2020; Marchant & O'Donohoe, 2019). Digital devices now outnumber humans as information processors. At the present time, over 20 billion devices are connected feeding off over more than 50 billion sensors that track, monitor, or feed data to those objects (Zhang, 2016). Digital devices are everywhere and they seem to be changing everything.

What is often overlooked in this story is that digital innovation is not only about the objects (a.k.a., infrastructure, platforms, devices or other artifacts) – it is also about the processes they facilitate. Digital innovation may take the form of new technology but the key to its impact is that it unleashes generative capacity (Tilson, Lyytinen, & Sørensen, 2010): digital innovation yields ability to rejuvenate, to reconfigure, to reframe, and to challenge the way we see and understand the world and act within it (Avital & Te'Eni, 2009). In other words, digital innovation is the story about *how we change what we do* because of the digital technologies emerging around us.

To understand change, we need to understand process, and vice versa (Langley & Tsoukas, 2017). Offerings like Uber do not change the fact that we move from A to B; they change the *process* of finding, reserving, and paying for a ride. We still watch TV at home, but the *process* of choosing what program to watch and when to watch changes with digital platforms such as Netflix, Hulu and others. These processual changes continue to occur even in domains that are already digitized. For example, the *process* of transferring money is fundamentally different on a blockchain system than the process of transferring money on a conventional digital network, such as SWIFT.

These examples begin to suggest that the established terminology of digital innovation, such as generativity and recombination, is not only about digital technology per se (technological objects, devices and artifacts). Digital innovation is also the story of means for changing and facilitating new pathways of action (Arthur, 2009; Garud, Kumaraswamy, & Karnøe, 2010; Hargadon, 2006). Creating new process pathways can have dramatic side effects. For example, the emergence of social media made our ability to connect with family and friends faster, better and cheaper, but it has also fundamentally changed the political process. Heads of nations now make major policy announcements via Twitter. Micro-targeting of political advertisements made it possible to create "alternative facts" in political discourse. These kinds of changes go beyond the substitution of one tool for another in the pursuit of greater speed, lower cost or higher quality. Digital innovations can open up whole new arenas of activity.

Since digital innovation transforms process, one might wonder whether these transformations can or need to be managed. Generative capacity is open-ended, creative, and innovative but it is also ambiguous, divergent and unknown (Avital & Te'Eni, 2009). It is easy to imagine that in some settings, generativity is counterproductive and operational efficiency critical (e.g., in mission-safety systems, in controlling manufacturing systems, or in handling a pandemic). Moreover, digital innovation creates opportunities for deviation, but does it also create opportunities for optimization? Does it create opportunities to rethink, redesign or repurpose processes? In short, could digital innovation benefit from business process management (BPM), perhaps the most prominent management practice to improve operational efficiency (Benner & Tushman, 2003)?

Before we can contemplate answers to these questions, we need to look at the opposite question: does BPM benefit from digital innovation? Isn't there already a blend of operational efficiency and generative capacity in contemporary business process management technology and practice? BPM has always combined knowledge from information technology and management science to create methods, techniques, and tools to support the design, enactment, management, and analysis of operational business processes (Dumas, La Rosa, Mendling, & Reijers, 2018; van der Aalst, 2013; vom Brocke & Rosemann, 2015). One traditional focus of BPM research has always been the role of digital technology in enacting, managing and innovating business processes. This focus has led to the rise of workflow management

systems, BPM suites, process mining technology, robotic process automation and other key technological innovations.

Indeed, the same advances in software and hardware that have given rise to digital innovation (Yoo, 2010; Yoo, Boland, Lyytinen, & Majchrzak, 2012; Yoo, Henfridsson, & Lyytinen, 2010) have also drastically expanded the spectrum of technologies relevant for BPM. Alongside classical process-centric technological innovations such as enterprise systems or workflow management systems, new digital technologies such as mobile and distributed computing, social media, digital platforms, data analytics, artificial intelligence, distributed ledger technology, cloud computing, and so forth have become increasingly important to the management of business processes (Hull & Motahari-Nezhad, 2016; Mendling et al., 2018b; Schulte, Janiesch, Venugopal, Weber, & Hoenisch, 2015; Swenson, 2012). The currently debated potential of implementations such as Blockchain for governing financial and regulatory processes in a decentralized fashion (Beck, Müller-Bloch, & King, 2018; Rieger, Guggenmos, Locki, Fridgen, & Urbach, 2019) or the increasing attention to robotic process automation (Lacity & Wilcocks, 2017; Mendling, Decker, Hull, Reijers, & Weber, 2018a) are just two examples out of many.

Must the Literatures on Digital Innovation and BPM Come Together?

Intuitively, BPM and digital innovation may appear as the opposite ends of the performance spectrum ranging from operational efficiency to generative capacity (Avital & Te'Eni, 2009). But history also shows they have natural synergy. After all, digital innovation has made current practices in BPM possible just as much as digital innovation is changing the way how we manage processes, both in business and private settings. However, for a variety of reasons, the research literature in each area has gravitated towards divergent phenomena, assumptions, settings and methods. Table 1 provides an overview of some of the main differences between the literature in each area.

One difference lies in the choice of phenomenon. BPM research looks at how processes are designed as sequences of activities. Digital innovation research looks at how processes are unfolding, with an eye on emergent changes in technology and organizing.

BPM research focuses on analytical and computational approaches to generate design artifacts such as frameworks, methods or technology that support the execution and management of processes in

organizations. In this way, BPM largely follows prescriptive research objectives that relate to the question how a process can be improved. Over decades, this focus has led to the development of enormous strengths in the design of artefacts and analytical and computational techniques. Digital innovation research, by contrast, is largely explanatory and empirically descriptive, trying to understand how processes come into being and how they change, both within and across organizations. Its objective is analysis and explanation, through theory development and validation. As such, it brings to bear considerable expertise in inductive and deductive theory development, phenomenological and empirical research in context.

Through these choices in phenomena, foci, and objectives, different methodological strengths emerged in each stream of literature as well as diverging assumptions. First, assumptions regarding design and solution space are different. BPM is essentially about separating problem and solution space (e.g., as-is modeling and to-be modeling are two discrete stages). But in digital innovation, problem and solution space emerge and co-evolve (von Hippel & von Krogh, 2016) – both are constantly in flux, we can never really "fix" one of them.

Second, assumptions regarding design versus emergence are different. The classical BPM approach unfolds top-down from strategic requirements, architectural design towards process implementation. Digital innovation largely emerges bottom-up to unleash generativity that arises from the small.

Third, assumptions regarding temporality are different. BPM defines a discrete stage-driven design process, which in its extreme form resembles the infamous waterfall model. Digital innovation often unfolds in an ad-hoc and anarchistic fashion driven by situational opportunities.

Fourth, assumptions regarding boundedness are different. Digital innovation is process innovation without bounds. BPM is bounded, for example, to organizational containers, to help concretize, bind and therefore tame the generative potential of digital innovation in order to offer tangible value to businesses.

Table 1: Differences in the research literatures on BPM and Digital Innovation

Aspect	BPM	Digital Innovation
Phenomenon	Process as designed: temporal and logical sequences of activities	Process as unfolding: emergent changes in technology and organizing
Dominant research approaches	Analytical, computational	Explanatory, empirical
Setting	Within organizations	Both within and beyond organizations
Objective	Largely prescriptive: what can be improved?	Largely descriptive: what is going on?
Strengths	Design, artefacts, computational techniques	Theory, contextualized and phenomenological insights
Key assumptions	1. Problems and solutions are separate and disjoint. 2. Management is driven from the top through design. 3. BPM is rendered in discrete lifecycle stages. 4. Innovations are bounded within organizational processes.	1. Problems and solutions emerge and co-evolve together. 2. Generativity arises in the small, from the bottom up. 3. Digital innovation is rendered in the "here and now". 4. Both digital innovation and processes are unbounded.

The picture that emerges from this discussion of each literature is one of two halves that are separate, not joined together. It is not obvious whether BPM and digital innovation must come together; perhaps the literature rightfully portrays both topics as orthogonal to each other. To explore the validity of this speculation, we now engage in a thought experiment that considers the pure form of each topic and literature in isolation.

Digital Innovation in Isolation

Digital innovation describes new products, processes, or business models that are embodied in or enabled by digital technology (Fichman et al., 2014). This view emphasizes two points. First, digital innovation is inherently socio-technical, addressing both changes in technological systems (such as hardware and software) and social systems (such as processes, structures and norms) brought forward through digitalization. For example, the operations facilitated by platforms such as Uber or Task Rabbit make it hard to envision digital innovation without an explicit integration of a process perspective. There

are novel technical processes, but also novel social processes for all platform participants (e.g., think Uber drivers and Uber riders, think different routes taking for commute, think differences in planning holidays without a rental car).

Second, digital innovation blurs the boundaries between process and outcome. Products as outcomes of innovation processes may themselves spawn, or be involved in, further innovation processes (Boland, Lyytinen, & Yoo, 2007; Kyriakou, Nickerson, & Sabnis, 2017). Conversely, innovation processes can continuously render products fluid, malleable and emergent (Arazy, Lindberg, Rezaei, & Samorani, 2020; Kallinikos, Aaltonen, & Marton, 2013), making them fit for change and innovation after market launch and in-use (Werder et al., 2020). This is neither new nor surprising. Contemporary forms of organizing, such as Agile or DevOps (Bass, Weber, & Zhu, 2015; Cram & Newell, 2016), already cater to the scenario that products (e.g., cloud services) and processes (e.g., development, service delivery and change management) are deeply intertwined. There are many other examples that demonstrate that integrative models of innovation and operation are on the rise (Puranam, Alexy, & Reitzig, 2014). Digital innovations as products and processes are not separate, they are coming together.

BPM in Isolation

BPM in isolation characterizes an approach that tends to be inward-looking and attempts to incrementally improve (but not decisively innovate) processes. Incremental improvement has been the historical focus of operational excellence programs of the 1970s to 1990s such as lean management, six sigma or total quality management. All of these programs imposed a strong emphasis on control while providing tools for exploring solutions for given, fixed problems (Powell, 1995; Ries, 2011; Schroeder, Lindermann, Liedtke, & Choo, 2008). The focus of these approaches has been largely on continuously improving already existing business processes within their current boundaries of operation (Benner & Tushman, 2003). At the center of these approaches is the discovery and modeling of the existing business process (“as-is”). The ambition is to identify waste and corresponding root causes, such that waste can be eliminated (i.e. unnecessary motion, transportation, inventory, defects, etc.) in new processes (“to-be”). These techniques and views remain commonplace in BPM teaching and practice to this day, even though

some attention is given to techniques for innovation (Dumas et al., 2018; vom Brocke & Mendling, 2018; vom Brocke et al., 2014).

When BPM is restricted to searching fixed problem spaces, it is susceptible to the costs associated with formulating what the problem space is (von Hippel & von Krogh, 2016). This problem is commonplace during "as-is" process modeling – often a considerable time and cost investment with unclear, indirect, or indeterminate benefits (Indulska, Green, Recker, & Rosemann, 2009; Indulska, Recker, Rosemann, & Green, 2009). Moreover, by limiting BPM to existing problems, managers forego opportunities for solutions that involve proactive approaches, such as searching and implementing solutions before problem arises (Benner & Tushman, 2003; Poll, Polyvyanyy, Rosemann, Röglinger, & Rupprecht, 2018). If BPM is purely reactive, managers would need to wait for digital innovations to impact existing business processes and manifest problems that require "fixing".

In essence, without the outward-looking ambition inherent in digital innovation, BPM largely equates with a program of fixing problems and eliminating waste. Such a program introduces novelty to the business process only to a limited extent as the overarching process logic is not questioned. Moreover, the output of any process remains largely unchanged. Everything that makes digital innovation unique – capacities for programmability, malleability, and change (Ekbia 2009; Kallinikos et al. 2013; Nambisan et al. 2017; Yoo et al. 2010, 2012) are lost in the imposition of stable, fixed process designs as prescribed by blueprints for execution in the form of flow charts, written procedures or algorithmic workflows. Fixed designs mean treating evolution, drift and unprompted change not as sources of generativity and evolution (Pentland, Liu, Kremser, & Hærem, 2020a) nor as positive deviances that yield gains in performance (Mertens, Recker, Kohlborn, & Kummer, 2016) but rather as deviations that need to be halted (Nguyen, Dumas, La Rosa, Maggi, & Suriadi, 2014), loss of control that needs to be avoided (Ciborra, 2000), or exceptions that need to be managed (Casati, 1999).

Can the Literatures on Digital Innovation and Business Process Management Come Together? Three Exemplars

Neither the literature on digital innovation nor BPM is sufficiently comprehensive to capture the coalescence and emergence of digital innovation as enacted in, transpiring through, and transformative of, processes. The literatures to date have been isolated and divergent. Going forward, they must come together.

Our special issue was compiled with that goal in mind. We wanted to attract papers that provided new theory or evidence for explaining how digital innovation enables, constrains, shifts or otherwise upends the design, enactment, management, and analysis of operational business processes. Likewise, we wanted to see how technology, techniques and theory from the management of business processes can assist an understanding of digital innovation processes and outcomes. We wanted to know whether operational efficiency and generative capacity can be balanced, and if so, how. Furthermore, we wanted to reach out to those two different, isolated communities and provide them with a forum where their ideas, theories and insights could meet and transcend the boundaries of their respective literature streams.

In response to our call we received twenty-two submissions. After a rigorous review process with multiple rounds of revisions, we selected three studies for inclusion in this special issue. These papers serve as exemplars of the opportunities that arise when we consider BPM and digital innovation together, rather than separately. All three have in common that they focus on emergent digital technologies (such as new digital infrastructure, new digital product/service offerings, or new data analytics) and explore how these innovations challenge assumptions inherent in traditional approaches to BPM. All three establish linkages between the literatures of BPM (process modeling, process management, process innovation) and digital innovation (digital infrastructure, digital transformation, data analytics). All three make connections between conversations that previously existed only in isolation.

"Architectural Alignment of Process Innovation and Digital Infrastructure in a High-Tech Hospital," by Bygstad and Øvrelid (2020), explores the link between BPM and digital infrastructure. Using data from an in-depth case study of a Norwegian hospital, they identify contrary assumptions about infrastructure and BPM, and in turn propose a combination of governance and architecture alignment

mechanisms that promotes successful process innovation. They focus on the role of lightweight technology, such as smart phones, tablets, apps, and whiteboards, in process innovation. These technologies can support rapid process change without extensive engineering (Schmiedel & vom Brocke, 2015). The processes are emergent, but still need to be managed.

"Digital Transformation and the New Logics of Business Process Management," by Baiyere, Salmela, and Tapanainen (2020), reports on an ethnography that examines the link between the introduction of new digital product and service offerings and how these changes fit to BPM. The starting point of their work, again, is a mismatch in assumptions between BPM and digital transformation. Through their analysis, they propose new logics that include light touch processes (process), infrastructural flexibility (infrastructure) and mindful actors (agency) that together coin updated, more encompassing and flexible assumptions for how business processes can be managed.

"Examining the Interplay Between Big Data Analytics and Contextual Factors in Driving Process Innovation Capabilities," by Mikalef and Krogstie (2020), explores how big data analytics interacts with BPM. Using survey data from 202 chief information officers and IT managers working in a diverse set of businesses, they distinguish configurations that support incremental versus radical process innovation. They find that managerial skill, in combination with other factors, is a core requirement for radical process innovation.

Much like many of the other submissions we received but could not publish, these three exemplars display a variety in focus, ideas, and research methods (from ethnography to case study to quantitative research). While each paper delivers important contributions on its own, we see several commonalities between them. For example, in all of these papers, we notice a balance between process design and process emergence; neither logic is favored at the expense of the other. From a research perspective, there is a balance between prescription and description. From an outcome perspective, all studies suggest revisiting assumptions in either stream of literature in order to relax, not necessarily replace, some traditional beliefs. For example, the studies advocate *some* process design is necessary but in a light way. All advocate *some* management control; none pushes total emergence without structure. All draw attention to *some* aspects of agency and organizing – be they managerial skill, mindfulness, or boundary spanning resources.

Toward a Convergent Logic for Business Process Management and Digital Innovation

The exemplars in our special issue demonstrate the value of questioning current assumptions. Expanding upon their work, we can begin to formulate propositions for a converging conversation (Alvesson & Sandberg, 2011) about BPM and digital innovation. Table 2 summarizes these propositions, which we discuss in turn. They focus on process design because processes are at the center of both emerging technology (through digital innovation) and organizing (through BPM) (Swanson, 2019).

Table 2: Proposed convergent assumptions of BPM and digital innovation

Type of assumption	**Old assumption in BPM**	**Old assumption in digital innovation**	**Challenge to assumptions**	**Updated Convergent Assumption**
Separation of problem and solution	Problems and solutions are separate and disjoint.	Problems and solutions emerge and co-evolve.	It is impossible to fully anticipate how well a process design will work but it is also impossible to fully anticipate which process patterns will emerge without design.	Over time, process design has to balance new feature innovation with immediate feedback.
Design versus emergence	Management is driven by design from the top.	Generativity arises in the small, from the bottom up.	It is impossible to fully specify processes beforehand but some design is necessary to lend structure.	Over time, process design has to balance predefined structure and freedom for adaptation.
Temporality	BPM is rendered in discrete lifecycle stages.	Digital innovation is rendered in the "here and now".	It is impossible to anticipate how a process will be performed tomorrow but some continuous understanding will be required about what the process-as-performed currently looks like.	Over time, process management has to balance enforcement of process compliance with identification of positive deviance.
Boundedness	Innovations are bounded within organizational processes.	Innovations and processes are unbounded.	It is impossible to fully anticipate how processes are integrated and reused in emerging value-creation networks but all processes will be embedded in and personalized experiences to some extent.	Over time, process design has to balance local optimization and global options for reuse.

Proposition 1: Over time, process design has to balance new feature innovation with immediate feedback.

It is impossible to fully anticipate how well a process design will work. Assumptions of classical BPM that regard process design as finding a solution to a given process-related problem have become obsolete in a dynamic world driven by digital innovation. However, emergence is only half the story here.

Process design now at a larger scale exhibits characteristics that have been observed in design studies: problem understanding drives solution understanding and vice versa (Dorst & Cross, 2001), both in innovation (von Hippel & von Krogh, 2016) and process dynamics (Dittrich & Seidl, 2018). It is neither design as problem-solving nor emergence alone, but interventional design and endogenous evolution that continuously trigger each other.

A consequence of these observations is that approaches for managing business processes must learn from digital innovation methodologies: In simple terms, BPM must become more agile (Bruno et al., 2011). Process design has to become both more fine-grained and more continuous. Fast feedback and short learning cycles are required to test out which process design works best given the current business environment. Approaches that integrate concepts from AB-testing with BPM address some of these needs (Satyal, Weber, Paik, Di Ciccio, & Mendling, 2019). Fast implementation approaches like robotic process automation become increasingly important (Lacity & Wilcocks, 2017). These approaches are small-scale, fine-granular, they can be implemented in a short timeframe to automate tedious manual computer tasks like data entry or copy and pasting of data between separate computer applications. Likewise, variants of DevOps essentially provide similar solutions of a fine-grained continuous deployment to address some of these requirements (Bass et al., 2015). But all have in common that they impose some structure on emergence, even if only lightweight (Bygstad & Øvrelid, 2020) or light-touch (Baiyere et al., 2020) form. Through constraints, innovation will be focused and fostered. By constraining only minimally or temporally, the constraints will be amenable to change – the solution can change the problem.

Proposition 2: Over time, process design has to balance predefined structure and freedom for adaptation.

It is impossible to fully specify processes beforehand. Assumptions of BPM and digital innovation define the extremes of a spectrum between design driven top-down by management and generativity arising in the small in a bottom-up way. Insights from research into organizational routines describe a middle ground where business processes have an ostensive aspect (Feldman & Pentland, 2003) that encompasses a wide range of specific process performances. The openness of this concept suggests that socio-technical processes cannot be fully planned or automated. Because actions are situated, there

will always be some level of improvisation, error, exception and innovation (Feldman, Pentland, D'Adderio, & Lazaric, 2016), even when the goal is to keep the process stable.

In contrast, BPM has traditionally been supported by workflow technology in a way that processes have to be fully specified (Leymann & Roller, 2000). The deterministic nature of this technology has already been criticized in the 1980s (Hirschheim, 1986; Winograd & Flores, 1986). Various approaches have been proposed to make process execution more flexible (Reichert & Dadam, 1998, pp. e.g., ; van der Aalst & Weske, 2005). Much of the concepts developed in these research works have been integrated into adaptive case management systems and standards (OMG, 2016). The essential idea of these systems is to leave parts of the processes deliberately underspecified and to offer techniques to users for extending and adapting processes during enactment. Going forward, we expect to see a much stronger prominence of partial, flexible or adaptive process design or specification. Without it, there is no room for digital innovation to introduce malleability, blurring of boundaries and generative capacity for unprompted change – they all need room to nest and grow.

Proposition 3: Over time, process management has to balance enforcement of process compliance with identification of positive deviance.

It is impossible to anticipate how a process will be performed in the future. At its core, BPM follows a line of thinking in stage gates for specifying and rolling out a process. The status of an IT-supported business process is expected to be fully understood by its version number. In contrast, digital innovation implicitly embraces a strong process theory that denies this kind of clear structure as an ontological concept (Hernes, 2017). A weak process theoretical perspective defines a middle ground that both structure and evolution are mutually defining each other (Giddens, 1984). In the context of BPM, this means that a process design may exist as a specification, but it is uncertain how far the specification of a process might deviate from one day to the next. This means that management faces an ongoing knowledge gap about how the process really works over time (Pentland et al., 2020a).

In the light of this uncertainty, various technologies capable of ongoing monitoring and analysis have been developed, such as process mining (van der Aalst, 2011). In essence, process mining takes transactional data as an input for generating fine-grained process diagrams with information on path

frequencies and workload. In contrast to interrogative techniques of monitoring and analysis driven by business analysts, process mining offers fast and detailed evidence on the actual performance of a business process. It allows the discovery of hidden means-ends knowledge in an organization and its dissemination as much as the identification of inefficiencies and fraud (Jans, van der Werf, Lybaert, & Vanhoof, 2011).

Process mining is a prime example of a tool from BPM that can be used to understand and manage the effects of digital innovation (Grisold, Wurm, Mendling, & vom Brocke, 2020). But its application must change. The emphasis should be neither on discovery (van der Aalst, Weijters, & Maruster, 2004) of some presumably stable model that explains the process performance, nor on conformance checking (van der Aalst, 2005) of performances against a predefined model. Both applications assume a stable model for process performance and assume that non-conformance is problematic. Instead, applications of process mining should be as dynamic as the trace data it analyzes. Emphasis should be on uncovering stable paths and forms of patterning (Goh & Pentland, 2019) in ongoing process performances, to understand which process sequences will likely influence but not determine future process performances and to identify opportunities for positive deviance (Mertens et al., 2016).

Proposition 4: Over time, process design has to balance local optimization with global options for reuse.

It is impossible to fully anticipate how processes are integrated and reused in emerging value-creation networks. Many BPM concepts were developed with a focus on intra-organizational processes that operate with largely closed information systems supporting or enabling them. Many processes were built with the assumption that their context remains stable over longer periods of time, which, however, is often not the case (Rosemann, Recker, & Flender, 2008). But many such examples exist. Process design standards have for a long time used schemas that explicate internal processes and orchestrate these with "black boxed" external parties such as suppliers or customers (Silver, 2009). Classical Enterprise Resource Planning technologies such as SAP R/3 were the epitome of pre-designed processes running in an organization on the basis of a closed, company-wide enterprise system. Process mining for a long time examined event logs from a single information system from within one company. BPM, by and large, looked inward. Even process integration with open systems like the Internet were mostly straight-jacketed

with the help of precisely defined Electronic Data Interchange (EDI) messages, which were then technically integrated with XML and web service technologies (Lyytinen & Damsgaard, 2011).

Digital innovation has led to processes blurring these boundaries and transcending traditional organizational containers (Winter, Berente, Howison, & Butler, 2014). It has become impractical to evaluate where a "business" process ends and a "private" process begins (Kohlborn, Müller, Poeppelbuss, & Röglinger, 2014). Digitalized processes underlie both business and private experiences (Yoo, 2010), both of which are more emergent, more unstable, and less integrated than traditional organizational business processes. Both business and everyday processes are increasingly enmeshed, constantly changing and reinforcing one another. Structure and boundaries blur and mingle.

We already witness these developments being integrated into new digital technology. For example, distributed ledger technology can be seen as the first true class of information systems supporting fully open inter-organizational business processes (Mendling et al., 2018b). The key feature of this technology is not its support for secure transactions with unknown or untrusted parties, but instead its capability to use smart contracts for weaving together emerging value chains of transactions in an unanticipated and non-pre-specified way. Similarly, platform-based infrastructures and ecosystems support comparable notions of openness and reconfiguration within and across companies and networks of partners, customers and complementors (Tilson et al., 2010; Tiwana, Konsynski, & Bush, 2010). Common to well-known platforms such as Netflix, Uber and others is the underlying design of a microservice architecture, in which numerous smaller software services are loosely integrated and orchestrated using processes. Netflix Conductor, Uber Cadence and Amazon AWS are examples of process execution frameworks that support this weaving together, giving rise to less pre-defined, emergent interwoven networks of processes, private and business, that lead to the enmeshment we have all come to experience in our digitalized reality. In short, we must abstain from a restrictive interpretation of the term "business" in BPM – BPM increasingly means managing interwoven, digitally-enabled networks of private and business processes.

Joining Forces through Methods

The communities that have studied BPM and digital innovation have so far relied on different methodologies. Much of the research on BPM draws on formal and computational methods, while most of the research on digital innovation draws on qualitative and quantitative empirical methods. Where others may see methodological disjointness, we see at least two opportunities for synthesis that yield untapped knowledge generation potential.

A first opportunity lies in the application of a research approach dominant in one field to reach the dominant objective of the other. For example, empirical methods, such as those used in digital innovation research, have traditionally been used to generate hypotheses and develop new theory. BPM technologies such as process mining are not that different. They are essentially pattern recognition techniques that allow learning inductively from data. Much of the data generated through digital innovation is in the form of digital traces – evidence of activities and events that is logged and stored digitally (Freelon, 2014, p. 59). In other words, digital trace data essentially is process data (Pentland, Recker, Ryan Wolf, & Wyner, 2020b). Process mining could thus be used to mine digital traces to learn patterns about anything people do that is mediated by digital technologies (Yoo, 2010). This capability is extremely important: in digital innovation, value from technology comes alive within routines (Swanson, 2019), which offers the prospect of using BPM technologies, such as process mining, to develop theory and test hypotheses about process change (Grisold et al., 2020).

A second opportunity arises from the increasing need to understand context, both in BPM (Rosemann et al., 2008) and digital innovation (Avgerou, 2019). Technology is mangled (Pickering, 2010), entangled (Orlikowski, 2007) and imbricated (Leonardi, 2011) with its social and material context. This entanglement is processual, in the sense that it unfolds and emerges over time (Emirbayer, 1997; Tsoukas & Chia, 2002). The importance of context has long been recognized in BPM and digital innovation, albeit under different assumptions and with different approaches. For example, BPM has developed conceptualizations (Rosemann et al., 2008), methods (Bose & van der Aalst, 2009) and technologies (Günther, Rinderle-Ma, Reichert, Van der Aalst, & Recker, 2008) to embrace context. Digital innovation research has used empirical and computational methodologies to study context

(Gaskin, Berente, Lyytinen, & Yoo, 2014; Majchrzak & Malhotra, 2016). The opportunity that arises is to embrace the methodological toolkit employed in digital innovation research, such as computational social science, or through configurational analysis as demonstrated by Mikalef and Krogstie (2020) in this special issue, within the development and evaluation of BPM technology. Likewise, researchers can draw on BPM technology (such as process mining or process analysis) to develop computational tools for analyzing contextuality (Berente, Seidel, & Safadi, 2019; Pentland et al., 2020b).

These opportunities should not be missed by either side. To meaningfully analyze the ever-increasing volume and breadth of digital traces, digital innovation research should turn to the analytical and computational competence rigorously developed in decades of research on BPM. As data for process theory moves away from being primarily qualitative in nature (Berends & Deken, 2020; Pentland, 1999) to include computed, numerical traces, the advanced technology that is available in process mining and analysis should be the starting point for the development of further computational approaches to theory development (Grisold et al., 2020; Nambisan, Lyytinen, Majchrzak, & Song, 2017). Collaboration among experts from both fields should be extremely productive.

Likewise, BPM research can no longer rely on analytical, formal and computational approaches alone. Digital innovation comes alive as technology-in-use during process performances (Swanson, 2019). To understand emergence, unfolding and coupling in digital processes, we need to study them *in situ*, with digital traces but also with empirical or ethnographic field work. As two papers in our special issue aptly illustrate (Baiyere et al., 2020; Bygstad & Øvrelid, 2020), understanding BPM in a digital world paradoxically requires more empirical, inductive field work. Computational and formal models alone are not sufficient. This situation asks BPM researchers to invite colleagues from digital innovation and other empirically-dominated fields to bring their methodological capability and rigor into the community.

Conclusion

Our objective in this introductory essay and the special issue has been to encourage convergence between BPM and digital innovation research. BPM and digital innovation belong together, like two sides of the same coin. In the 1990s, the original version of BPM was inspired by digital innovations.

Even then, emergent digital technology (e.g., computer networks and databases) made it possible to "re-engineer" workflows, often with dramatic success (Davenport, 1993; Hammer & Champy, 1993). But in spite of Hammer's (1990) classic advice ("don't automate, obliterate"), the radical approach of the early 1990s evolved into the more conservative, incremental top-down approach we see in contemporary BPM (Dumas et al., 2018; Smith & Fingar, 2003).

Now, for better or worse, digital innovation is re-engineering, re-inventing and in some cases obliterating whole domains of activity without any engineering at all. Yet, in spite of the current divide that we see in the literature, it remains clear that BPM and digital innovation are complementary fields of inquiry that have much to learn from, and offer to, each other. Devices and routines create capabilities (Swanson, 2019). Processes, technologies and products are intertwined. To evaluate this complementarity, scholars in each field will need to examine their assumptions, methods and questions. To capitalize on the complementarity, they need to begin opening their conversations to one another. This special issue hopefully serves as a trigger.

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