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Using a Work System Perspective to Expand BPM Research Use Cases

Steven Alter
University of San Francisco
alter@usfca.edu

Jan Recker
Queensland University of Technology
j.recker@qut.edu.au

Abstract:

Business process management (BPM) has developed as a research field primarily situated in the computer and information systems sciences. Recently, van der Aalst (2013) analyzed the results of these research efforts and identified a set of research topics in the form of a series of BPM research use cases. Those BPM research use cases emphasize technological and computational challenges and solutions. Ideally, however, BPM research should also address managerial and organizational challenges that the existing technically oriented research use cases do not fully reflect. We propose expanding the scope and impact of BPM research by drawing on work system theory (WST) to identify new BPM research use cases and directions. After comparing a WST perspective on basic BPM topics with the technically oriented BPM perspective expressed in van der Aalst (2013), we present new research topics that extend the technically oriented BPM research use cases in van der Aalst (2013). We also present new research directions that go beyond those use cases. Taken together, the extensions of the existing research use cases and the new use cases lead to a more balanced BPM research agenda that more fully blends technical and managerial challenges.

Keywords: Business Process Management, Work System Theory, BPM Use Cases, BPM Research Agenda.

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1 Toward Expanding the Scope and Managerial Value of Technically Oriented BPM Research Use Cases

The term "business process management" (BPM) sounds as though it refers to a management discipline but, in research practice, often seems more like a branch of computer science. This divergence starts from the way different scholars operate from different views of what BPM is. On the one hand, Rosemann and vom Brocke (2015) identify six "core elements" of BPM: strategic alignment, governance, methods, information technology, people, and culture. The names of those core elements make BPM sound like a study of work systems (Alter, 2013), operations management, or even a branch of general management and work design (Recker, 2014). Scholars working from this perspective conduct research on process-improvement methods (Bolsinger, Elsäßer, Helm, & Röglinger 2015), BPM culture (vom Brocke & Sinnl, 2011), and related topics. In contrast, scholars more attuned to the approach expressed in van der Aalst (2013, p. 1) suggest that BPM is an extension to workflow management that ranges broadly in scope from process modeling, process automation, and process analysis to operations management and the organization of work. Research from this perspective focuses on abstractions, BPM languages, and computerized methods. Most of it pays little attention to typical management concerns related to process operation, such as establishing and maintaining productivity and quality, satisfying customers, and organizing and motivating people.

One can also see the divergence between these two veins of BPM research elsewhere. Table 1 uses two current sources to illustrate the divergence between computer science-oriented and management-oriented views of BPM issues. The first column shows the categories of BPM research use cases that organize a discussion of key BPM concerns in a recent review paper about BPM (van der Aalst, 2013). Our paper responds to that paper. The second column, from Gartner (2015), lists the "hot topics" advertised for Gartner's Global BPM Summit in June 2015. The difference in emphasis is striking: the key concerns from van der Aalst (2013) makes BPM look like a branch of computer science, whereas the hot topics from the Gartner conference makes BPM look like a management topic. The wide gulf between the two approaches calls for ideas that begin to bridge the two approaches.

Table 1. BPM Key Concerns and "Hot Topics"

Key BPM concerns from van der Aalst (2013)	Hot topics in BPM (Gartner, 2015)
• Process modeling languages • Process enactment infrastructures • Process model analysis • Process mining • Process flexibility • Process reuse	• Defining the value of BPM to business and IT • Managing change as you improve processes • Making process governance work • Developing key roles and skills for process improvement • Measuring business outcomes in a process context

In this paper, we draw on work system theory (WST) (Alter, 2013) to expand and augment many of the 20 technically oriented research use cases discussed by van der Aalst (2013) and, thereby, provide bridges toward topics and concerns of the types mentioned in Table 1 as Gartner's hot topics. We mention managerially oriented BPM publications, such as the edited volumes by vom Brocke and Rosemann (2010a, 2010b), but do not focus on past BPM-related research that addresses managerial issues directly or indirectly. Instead, we focus on the more challenging and potentially more valuable question of how a WST perspective can broaden the scope of van der Aalst's (2013) BPM research use cases. Moving in that direction increases the breadth and integration of BPM. It provides ways to increase the scope of BPM while also recognizing that technically oriented research continues to generate important results.

Contribution:

Most current BPM research use cases identified in a review of BPM research (van der Aalst, 2013) emphasize technical and computational perspectives and deemphasize managerial perspectives. We draw on work system theory (WST) to offer an expanded view of BPM use cases that also incorporates managerial and organizational research issues and opportunities. Application of a work system perspective leads to new or expanded topics for BPM research that could have significant impacts on BPM's technical and managerial aspects. Our expanded research agenda for BPM aims for a better balance between technical and managerial challenges and, in turn, can inspire holistic research results in future BPM scholarship.

We produce a conceptual contribution to BPM research by responding to van der Aalst (2013). We build on WST to support a more managerial view of BPM than is apparent in the currently predominant view of BPM research use cases. We show how a WST perspective on BPM could address important aspects of business process management in ways that seem beyond the current scope of most BPM research that has appeared in journals and conference proceedings. Specifically, we address the following research questions:

1. Can a WST perspective meaningfully expand the scope of BPM concepts?
2. Can a WST perspective expand existing use cases for technically oriented BPM research?

This paper proceeds as follows. In Section 2, we summarize BPM research use cases that van der Aalst (2013) discusses and key concepts of WST. In Section 3, we show how aspects of a WST viewpoint compare with key assumptions and viewpoints about BPM in van der Aalst (2013). In Section 4, we explain how the WST view generates both new extensions of existing BPM use cases and new use cases. Finally, in Section 5, we conclude the paper by summarizing its contributions.

2 Background

2.1 BPM Research Use Cases

This paper is a response to van der Aalst (2013), a recent BPM review paper that focuses on providing structure for a growing research discipline, reflecting on past research foci and achievements, and stimulating future research. That paper identifies 20 BPM research use cases that are divided into six categories as follows:

- **Use cases to obtain models**, which include 1) design model, 2) discover model from event data, 3) select model from collection, 4) merge models, and 5) compose model.
- **Use cases involving configurable models**, which include 6) design configurable model, 7) merge models into configurable model, and 8) configure configurable model.
- **Use cases related to process execution**, which include 9) refine model, 10) enact model, 11) log event data, 12) monitor, and 13) adapt while running.
- **Use cases involving model-based analysis**, which include 14) analyze performance based on model and 15) verify model.
- **Use cases extracting diagnostics from event data**, which include 16) check conformance using event data and 17) analyze performance using event data.
- **Use cases producing new models based on diagnostics or event data**, which include 18) repair model, 19) extend model, and 20) improve model.

Van der Aalst (2013) applies these use cases as a lens to reflect on prior research on BPM as published in the BPM conference series. The use cases also serve a generative purpose of highlighting gaps in the shared attention of the BPM community. For instance, van der Aalst (2013, p. 29) suggests that use cases related to improving the performance of processes are largely neglected. We also view performance as a central issue if BPM is to live up to its name.

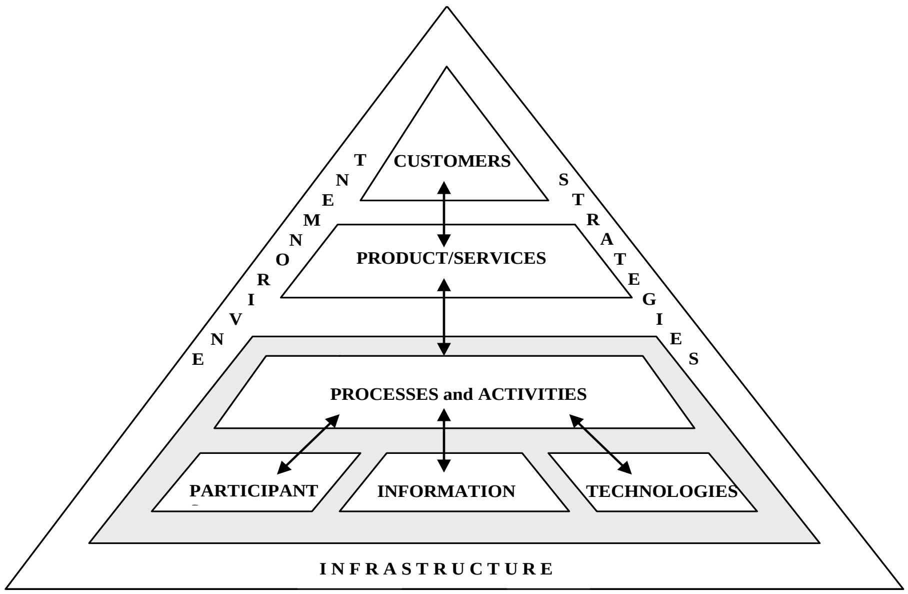
We believe van der Aalst’s (2013) viewpoint expressed by the six categories of BPM research use cases is accurate and useful; however, it is also limited in coverage and, consequently, impact. It pinpoints existing research in the computing sciences and identifies recognized gaps in knowledge. However, it says little about either existing or future research from perspectives outside the computing sciences; therefore, it cannot provide a bridge that connects and integrates managerial BPM research and technical BPM research. Building such a bridge is important to create more coherence for the existing divergent streams of BPM research, to help the field avoid isolation and starvation (Recker & Mendling, 2016), and, in turn, to achieve higher impact. We provide a step toward building the bridge, and we use WST to propose an extended view of BPM research use cases.

2.2 Work System Theory

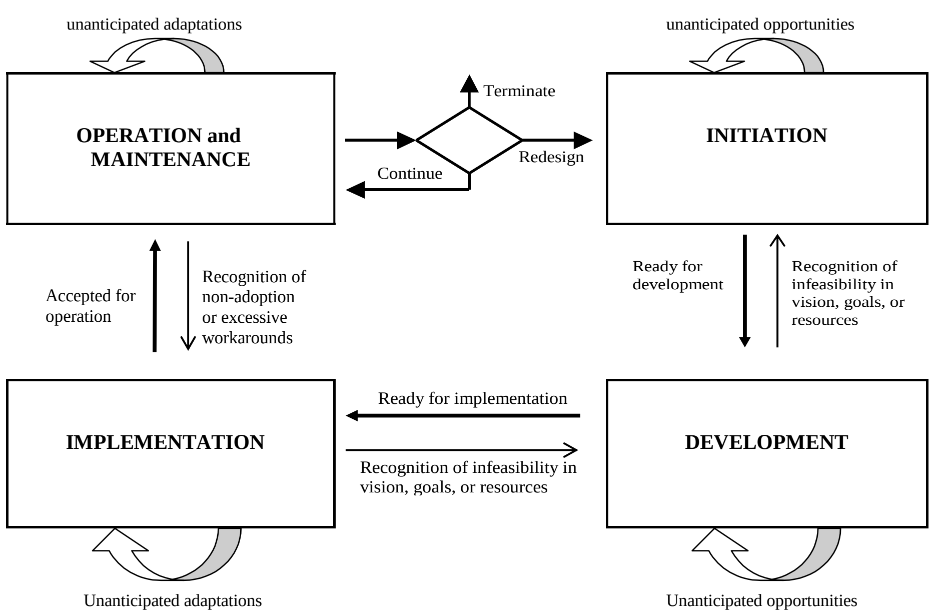
Work system theory (WST) is the basis of our expanded view of BPM as focusing on organizational process systems that may—or may not—use BPM software. Figure 1 presents three components of work system theory as defined by Alter (2013, 2015b).

A system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce specific products/services for specific internal and/or external customers.

1) Definition of work system



2) Work system framework



3) Work system lifecycle model

Figure 1. Three Components of Work System Theory (Alter, 2013)

While there is some disagreement about whether WST is a proper theory (Niederman & March, 2014), for our purposes, it suffices to say that WST comprises the three components in Figure 1; that is, the definition of work system, work system framework, and the work system lifecycle model. WST is the basis of various versions of the work system method (WSM), a systems analysis method designed to support the needs of business professionals (Alter, 2006). Experience with WSM demonstrated the need for various extensions of WST such as work system principles, work system design spaces, and a work system metamodel that reinterprets and elaborates concepts in the work system framework (Alter, 2013). We present the metamodel in Figure 2 because it forms a bridge between a basic WST viewpoint and a BPM viewpoint and, thereby, facilitates comparisons between WST concepts and technically oriented BPM concepts. In this section, we briefly explain key components of WST. To minimize redundancy, we defer additional observations about WST and the metamodel to Section 3.

2.2.1 Definition and Nature of Work Systems

A work system is a system in which human participants and/or machines perform processes and activities using information, technology, and other resources to produce product/services for internal or external customers. Enterprises that grow beyond an improvised start-up phase include multiple work systems such as work systems that procure materials from suppliers, produce products, deliver products, find customers, create financial reports, hire employees, coordinate work across departments, and perform other functions. Many work systems include automated subsystems whose work is performed by software. Information systems are a special case of work systems (i.e., work systems that are devoted to processing information). Many work systems do other things as well.

WST's default assumption is that work systems are sociotechnical (i.e., that human participants perform activities in those work systems and, therefore, are integral parts of the systems (not just users of technology)). By saying that human participants and/or machines perform work, this definition accommodates work systems that are totally social (making no significant use of technology), sociotechnical (with human participants who make significant use of technology), or entirely automated (such as software that operates autonomously once triggered by other automated entities and/or human work systems participants).

2.2.2 Work System Framework

The work system framework in Figure 1 identifies nine elements of a basic management understanding of a work system. For example, even a basic understanding of a work system includes knowledge about the internal/external customers, the product/services that the work system produces, and the environment in which the work system operates (such as organizational culture, competitive situation, and regulations). The arrows inside the framework say that those elements should be aligned.

2.2.3 Work System Lifecycle Model

The other diagram in Figure 1 represents iterations through which work systems evolve over time via a combination of planned and unplanned change. The planned change may or may not involve BPM software. If BPM software is used, the operation and maintenance of the work system may include software reconfiguration and/or adaptations and workarounds to overcome shortcomings of the software or other perceived obstacles to achieving organizational goals.

2.2.4 Work System Metamodel

Figure 2 is the sixth version of a metamodel that addresses limitations in the work system framework by reinterpreting each element in a more detailed way. The work system framework is useful for summarizing a work system and achieving mutual understanding of its scope and nature but is less effective for detailed analysis. In the metamodel, information becomes informational entity, technology is divided into tools and automated services, activities are performed by three types of actors, and so on.

Representation decisions in the metamodel try to maximize understandability while revealing likely omissions from evaluation, analysis, or design processes. The bottom of Figure 2 notes that the one-page representation of the metamodel hides many attributes of each entity type. Analysts using the metamodel would consider and apply the hidden attributes while defining the problem or opportunity, evaluating the "as-is" work system, and justifying proposed improvements that would appear in the "to-be" work system. The figure also represents the customer work system (in the upper right) because a complete understanding of a work system necessarily includes understandings or at least explicit assumptions about how customers attain value by using the product/service offerings that the work system produces. Also important for BPM is that the metamodel reveals relationships between a provider's human, informational, and technical resources and the value-in-use of the product/service offerings that the work system produces.

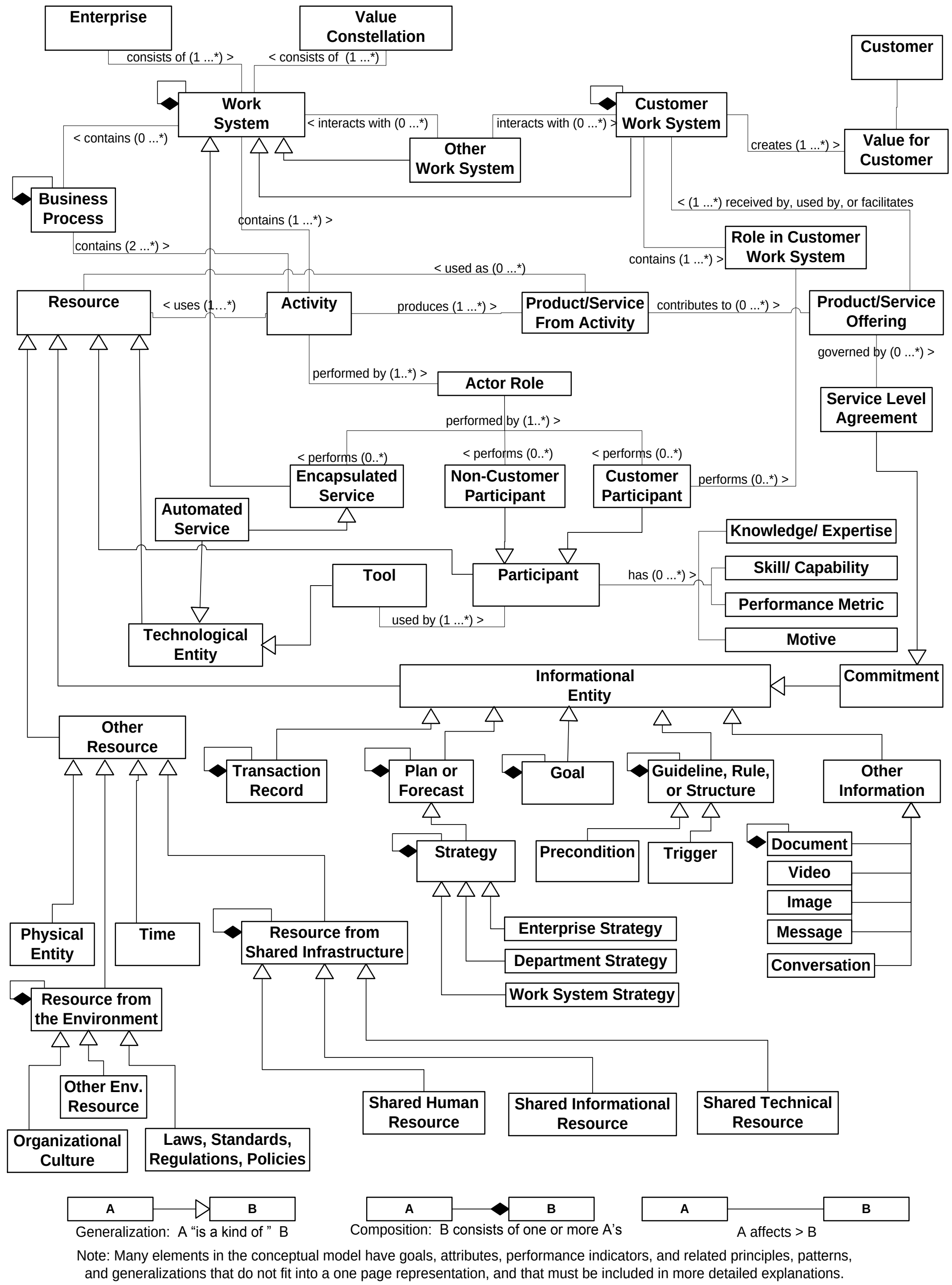


Figure 2. Work System Metamodel: Sixth Version (Alter, 2016)

3 Comparing a WST Perspective with a BPM Perspective

This section explains WST in the specific context of comparing typical BPM and WST views of important topics. We divide this section into five parts. The first covers general concepts including business process management, system, model, and automation. The second focuses on WST's view of business processes. The third mentions the eight other elements of the work system framework. The fourth mentions system change and evolution. The fifth discusses similarities and overlaps of WST and managerial BPM.

To identify typical BPM views, we draw primarily on quotations from van der Aalst (2013). As we explain above, some BPM research is based on other perspectives (for an overview, see Recker, 2014). Examples include the perspective offered by Rosemann and vom Brocke (2015) and perspectives that underlie process-related research in fields such as operations management (Armistead & Machin, 1997), software process improvement (Müller, Mathiassen, & Balshøj, 2010), or organizational design (Pentland 2003). However, because we use a recent and highly coherent single source, we can more easily illustrate general differences between WST views and the views inherent in most technically oriented use cases for BPM research. It also allows us to add a more managerial view on BPM to those types of research efforts that van der Aalst (2013) analyzes. The WST view is based on Alter's (2013) coverage of WST, its applications, and its extensions. That paper does not discuss BPM topics directly.

3.1 BPM and WST Views of Essential Concepts

Van der Aalst (2013, p. 1) states that BPM "combines knowledge from information technology and knowledge from management sciences and applies this to operational business processes". BPM contains four key activities that focus on process models that "capture the different ways in which a case (i.e., process instance) can be handled" (van der Aalst, 2013, p. 2). Those activities include creating a process model for analysis or enactment, using a process model to control and support concrete cases, analyzing a process using a process model and/or event log, and managing the sum of all other activities such as adjusting the process, reallocating resources, or managing large collections of process models. Van der Aalst (2013, p. 2) also mentions that a data perspective, time perspective, and function perspective "are essential for comprehensive process models".

A WST approach focuses on not only creating and managing process models but also operating and managing entire work systems. WST implies that a one cannot manage a business process without managing the work system because "processes and activities" is only one of nine elements of the work system framework (Figure 1). For example, the same process model enacted in two different locations or at two different times may generate completely different results if the human participants, information, technology, or customer demand differ significantly and sometimes even when those elements are quite similar.

3.1.1 What is a System?

Van der Aalst (2013, p. 5) says "there is an abundance of BPM systems. These systems are generic software systems that are driven by explicit process designs to enact and manage operational business processes.". Furthermore, "business processes can be classified into human-centric and system-centric, or more precisely into person-to-person (P2P), person-to-application (P2A) and application-to-application (A2) processes". The distinction between human-centric and system-centric seems to imply that van der Aalst treats the term "system" as a synonym of software.

While BPM software—and any other software—can be viewed as a system with inputs, processing, and outputs, from a WST viewpoint the system of primary interest is a work system, not the software systems it uses. A work system's human participants usually perform some activities that involve software and other activities that do not.

3.1.2 What is a Model?

Van der Aalst (2013, p. 2, emphasis in original) states: "the notion of a *process model* is foundational for BPM. A process model aims to capture the different ways in which a *case* (i.e., process instance) can be handled.". Van der Aalst (2013, p. 6) further states that models may be descriptive, normative, and/or executable. Regarding types of models, van der Aalst (2013, p. 3) states: "most of the contemporary BPM notations and systems use token based semantics adopted from Petri nets".

WST-inspired approaches treat process models as part of work system models. To date, modeling based on WST has been largely descriptive and far less formal than modeling in BPM. WST ideas can be used in normative models that describe how future work systems should operate and also provide a path toward executable models. WST does not call for any particular modeling notation. It assumes that deep analysis of any work system will probably start with relatively informal textual models that are easy to use for collaboration. In contrast with most highly formalized graphical or mathematical models, textual models based on WST tend to have very low extraneous cognitive load (Sweller, 1994) because they are based on familiar ideas and do not require use of overly precise concepts that are difficult for most people to understand. Later, as the analysis proceeds in more depth, it should apply whatever notations and modeling tools are useful. Those modeling tools might include models expressed through BPM software, service blueprinting (Bitner, Ostrom, & Morgan, 2008), value stream mapping from Six Sigma (Snee & Hoerl, 2003), BPMN modeling (Weske, 2012), or other techniques.

3.1.3 What is Automation?

Van der Aalst (2013, p. 1) states that one can see BPM “as an extension of Workflow Management (WFM). WFM focuses primarily on automation of business processes.”.

The WST view of automation assumes that a process or activity is automated if a machine executes it completely. From the perspective of WST, initiation, control, and tracking of process steps by BPM software basically concerns recordkeeping and control and not the automation of the steps themselves.

3.2 WST and BPM Views of Business Processes

Fundamental to this paper is a definition of business process that differs from definitions in other sources. van der Aalst, ter Hofstede, and Weske (2003, p. 4) define business processes as “operational processes involving humans, organizations, applications, documents and other sources of information”. Further, they note that: ”processes at the strategic level or processes that cannot be made implicit are excluded from the BPM focus’. Van der Aalst (2013, p. 5) further says “business processes can be classified into human-centric and system-centric, or more precisely into person-to-person (P2P), person-to-application (P2A) and application-to-application (A2) processes”. This categorization focuses on the relationship between individuals and software. More precisely, in this categorization, one can see much of the relationship between individuals and software in BPM systems as acts of orchestration: individual actors or agents execute work (in individual tasks) at their own discretion; however, the orchestration of the work’s flow (i.e., the control flow that orders activities) often forms the backbone for process models and the systems that build on these models (van der Aalst, 2013, p. 2).

A WST-inspired classification of business processes concerns the nature and details of the work and not the relationship of people to software. The work system framework uses the term “processes and activities” instead of business processes, which covers a wider range of possibilities in the extent to which activity sequences and content are explicit, formalized, prescribed, or generative. This view is more open and integrative than the BPM view described above. For instance, it acknowledges that some processes and activities may be ostensive routines while others may be generative (Pentland, 2003). It also acknowledges that some activities are artistic rather than procedural in nature and, hence, should or cannot be modeled or managed (Hall & Johnson, 2009). This view also acknowledges that processes and activities in work systems may be specified to varying degrees along a dimension from unstructured to structured:

- **Largely unstructured creative processes** (such as many design and management processes) that might use tools but that have no pre-specified sequence and may involve extensive iteration guided by the concerns and abilities of the people performing the work
- **Semi-structured knowledge processes** (such as medical diagnosis or legal analysis) that use tools and procedural knowledge but also have no pre-specified sequence and may involve extensive iteration
- **Workflow processes** (such as invoice verification or reimbursement) with a prescribed sequence but whose individual steps may be treated as black box subroutines whose details are unknown or are viewed as unproblematic, and
- **Highly structured processes** (such as pharmaceutical and semiconductor manufacturing) where both the workflow sequence and the details of each step must be specified and followed precisely.

The first two categories mostly fall outside the scope of today's BPM even though some BPM researchers have studied creative processes (e.g., Hall & Johnson, 2009; Seidel, Müller-Wienbergen, & Becker 2010). In today's prevalent view, BPM is basically an extension of workflow management (WFM), which applies to the third category above. The fourth category relates more to process-aware information systems (PAISs), which "include traditional WFM systems and modern BPM systems, but also include systems that provide more flexibility or support for specific processes" (van der Aalst, 2013, p. 1). Such systems (e.g., ERP, CRM, rule-based systems, call-center software, and high-end middleware) commonly use an explicit process model even though they may not control processes through a generic workflow engine.

3.3 WST and BPM Views of Other Elements of the Work System Framework

In this section, we explain how business process management in the WST sense requires one to consider the other eight elements of the work system framework. This coverage leads to many of the new or extended BPM use cases that we mention in subsequent sections. The characterization of BPM in this section is based on van der Aalst (2013) and may not be consistent with views inherent in other BPM research.

3.3.1 Customers

Work systems exist to produce product/services for their customers. Thus, managing a work system requires focusing on customers, who also may be work system participants (e.g., a user representative participating in software development or a patient in a medical exam). None of the 20 BPM use cases in van der Aalst (2013) focus on customers.

3.3.2 Products/Services

All work systems exist to produce one or more product/services that their customers receive, use, or experience (we use the term products/services because unresolved debates about general distinctions between products and services are unimportant for understanding, analyzing, or designing work systems). The metamodel in Figure 2 shows that each activity inside a work system produces at least one product/service that may go to a customer or that other activities in the same work system may receive and use, as occurs in assembly lines and value chains. None of the 20 BPM use cases in van der Aalst (2013) focus on product/services.

3.3.3 Participants

Participants are people who perform work system activities. In contrast to BPM, WST treats participants as part of a work system rather than just software users. It does so because their skills, knowledge, ambition, and care are key determinants of a work system's efficiency, consistency, and resilience and of the quality and reliability of product/services that it produces. The metamodel explicitly says that customers may play actor roles in work system activities (e.g., a patient in a medical diagnosis work system, a student in an educational work system). None of the 20 BPM use cases focus on participants in an explicit way.

3.3.4 Information

The metamodel identifies many different types of informational entities, all of which are important in at least some work systems. Consistent with observations by many social scientists, it assumes that relevant informational entities may or may not be computerized. The metamodel treats business rules (e.g., those that a business rule engine might manage) as a type of information that can be a resource for performing work system activities and that work system activities might change. The 20 BPM use cases assume that information will pass between process steps and that information will be recorded in event logs but do not focus on information used in process steps.

3.3.5 Technologies

The metamodel represents technologies in two forms: as tools that work system participants use (e.g., a knife used by a chef) or as automated services (e.g., a search engine) that perform work autonomously once launched by a triggering event or message. The metamodel says that one can view automated services as totally automated work systems, which is a step toward linking the business view of work systems with the computer science view of service orientation as architecture. The metamodel says nothing about BPM software but would treat it as technology that one might use in launching or executing work system activities. The 20 BPM use cases do not speak specifically about technologies other than BPM software.

3.3.6 Environment, Infrastructure, and Strategies

Mainstream BPM also does not treat the other three elements of the work system framework directly even though they are part of a basic understanding of a work system.

3.4 WST and BPM Views of System Change and Evolution

The notions of change and evolution are fundamental to both BPM and WST because both deal with improvement and adaptation. We will look at two related topics.

3.4.1 What is a Lifecycle?

Figure 4 in van der Aalst (2013, p. 5) shows an iterative BPM lifecycle that focuses on BPM software and contains three phases; namely, (re)design, implement/configure, and run and adjust. The focus of this lifecycle is a process (model) and how it may be changed through decisions made about it when requirements change.

In contrast, the work system lifecycle model (in Figure 1) focuses on a work system's evolution through iterations of planned change interspersed with unplanned change including adaptations, experimentation, and workarounds. It avoids the software-centric focus of the "system development lifecycle", which deals with producing and implementing software that meets requirements rather than about a work system's evolution through iterations of planned and unplanned change.

3.4.2 What is an Unplanned Change?

Historically, much BPM research seemed to assume that process specifications are accurate representations of business processes and will be followed. Exceptions are handled as deviances that should be eradicated. Process mining is an important challenge the BPM assumption that a process model describes how a process actually operates (van der Aalst, Weijters, & Maruster 2004).

WST assume that a work system's evolution includes both planned and unplanned change. Planned change occurs through formal projects that may or may not involve BPM software. Unplanned change occurs because work systems participants may or may not follow business process specifications. In some instances, the nonconformance is accidental. In others, it is an application of human agency (Eisenhardt 1989), such as where work system participants design workarounds to overcome generic ERP or CRM processes that they see as unnecessarily cumbersome. In some cases, workarounds are temporary, but, in others, workarounds turn into a form of unplanned change (Alter, 2014).

3.5 Similarities and Overlaps of WST and Managerial BPM

Before explaining how a WST perspective suggests directions for augmenting technically oriented BPM use cases, it is useful to compare the WST perspective with a managerial perspective on BPM.

This section treats Rosemann and vom Brocke (2015) as an exemplar of a managerial perspective on BPM. Table 2 uses two dimensions to compare the positioning of WST with the positioning of three other viewpoints: 1) the extent of focus on process models versus general management issues and 2) the extent of focus on managerial issues versus technical issues. General management is in the lower left because it may focus on work systems or on other management topics, such as organization of work, personnel issues, strategic decisions, and company culture. Next is WST, which focuses specifically on work systems, not general management, and which has more of a managerial flavor than a technical flavor even though it provides a path toward technical issues, as we illustrate in Tables 3 and 4. Managerial BPM focuses specifically on process management and process improvement almost always through the use of BPM software. Finally, van der Aalst's (2013) technical use cases primarily concern process models and generally have highly technical emphasis.

Table 2. Framework for Comparing WST, Managerial BPM, and van der Aalst's (2013) Technical Uses Cases

Focus on process models				van der Aalst's (2013) technical use cases
Focus on process management and process improvement			Managerial BPM	
Focus on work system analysis, design, improvement		Work system theory		
General management	Management of work and other management concerns			
	Focus on managerial issues			**Focus on technical issues**

Overall, Table 2 suggests that managerial BPM focuses more singularly on process issues than WST and that van der Aalst's (2013) technical use cases focus more on process models than managerial BPM. Based on the positioning in the Table 2, adding aspects of a WST perspective to either managerial BPM or the technical use cases would tend to illuminate issues that are more in the direction of management and, hence, would be described as being more fully about the management of business processes.

To compare WST and managerial BPM in a bit more detail, we look at the six "core elements" of BPM that Rosemann and vom Brocke (2015) describe: strategic alignment, governance, methods, information technology, people, and culture.

3.5.1 Strategic Alignment

Rosemann and vom Brocke (2015, p. 112) state that "processes have to be designed, executed, managed, and measured according to strategic priorities in specific strategic situations". Strategy constitutes one of the work system framework's elements (Figure 1). The work system approach assumes that the structure and operation of a work system should be consistent with enterprise strategy and department strategy. However, WST focuses on specific work systems and carefully avoids assuming that every work system has strategic importance or genuinely needs to be considered from a strategic perspective. Some work systems are strategically important. Others simply aren't but still need to be created, operated, and managed in order to produce internally or externally directed product/services that are needed for one reason or another.

3.5.2 Governance

WST does not include a separate governance component. It assumes that governance itself is actually a work system and can be analyzed as such. Rosemann and vom Brocke (2015, p. 113) first describe governance as follows: "BPM governance establishes appropriate and transparent accountability in terms of roles and responsibilities for different levels of BPM". The metamodel outlines a step toward accountability by identifying actor roles for each activity in the work system. Thus, while there is no disagreement about governance, WST says nothing specific about the governance of BPM.

3.5.3 Methods

Rosemann and vom Brocke (2015, p. 113) say that "methods in the context of BPM are defined as the set of tools and techniques that support and enable activities along the process lifecycle within enterprise-wide BPM initiatives…. Examples are methods that facilitate process modeling or process analysis and process improvement techniques. Six Sigma is an example [of] a BPM approach that has at its core a set of integrated BPM methods.". Alter (2013, p. 99) treats Six Sigma as an example of:

> *methods and tools that are typically viewed as external to the IS discipline but are certainly applicable when thinking about IT-reliant work systems. Such methods should be used wherever they might provide insight and where the required data is available or can be collected.*

In other words, WST and BPM do not disagree about using tools and methods that are applicable for analyzing or designing processes. The same tools and methods that Rosemann and vom Brocke (2015) cite as examples are equally relevant to analyzing many operational work systems.

3.5.4 Information Technology

Without defining the term "solution", Rosemann and vom Brocke (2015, p. 113) say:

> *IT-based solutions are of significance for BPM initiatives. With a traditional focus on process analysis (e.g., statistical process control) and process modeling support, BPM-related IT solutions increasingly manifest themselves in the form of process-aware information systems (PAIS) (see Dumas, van der Aalst, & ter Hofstede, 2005). Such process awareness could be the result of input in the form of process models or could be more implicitly embedded in the form of hard-coded processes (like in traditional banking or insurance applications).*

WST makes no conceptual or categorical distinction about whether a work system contains commercial BPM software or whether it is "process aware". WST assumes that any type of technology may play a role in a work system. WST says nothing about "process awareness" because it is usually impossible to manage a work system effectively unless its participants and their managers are aware of how its quality-sensitive processes operate.

3.5.5 People

Rosemann and vom Brocke (2015, p. 113) say that "people as a core element of BPM is defined as individuals and groups who continually enhance and apply their process and process management skills and knowledge in order to improve business performance". WST views work system participants as everyone who plays an actor role in one or more activities in a work system. The metamodel specifically notes the importance of their knowledge/expertise, skills/capabilities, performance metrics, and motives, all of which may apply to specific BPM concerns and to any other concerns that are relevant to the work system.

3.5.6 Culture

Rosemann and vom Brocke (2015, p. 113) say that "BPM culture incorporates the collective values and beliefs in regards to the process-centered organization". WST takes a broader, more typically managerial view of culture that includes organizational culture and national culture. Thus, it treats culture as much more than BPM culture that focuses on collective values and beliefs related to BPM philosophy (vom Brocke & Sinnl, 2011).

3.6 Work System Metrics and Characteristics

While BPM focuses on business process structure and its implications for performance, WST concerns work systems. Analyzing and designing a work system necessarily calls for attention to metrics for evaluating how well an existing work system has operated or how a proposed work system will operate. Common internal metrics for managing the operation of work systems include production cost, efficiency, speed, consistency, rework, and extent of stoppages, which are metrics not dissimilar to those used in process analysis (Dumas, La Rosa, Mendling, & Reijers 2013). Common external metrics include total cost to customers, quality perceived by customers, responsiveness to customers, and so on. Work systems and each of their elements may also have other metrics, any of which may be important in some situations and unimportant in others.

Work system characteristics may also be important in analyzing and designing systems. Commonly cited work system characteristics include scalability, flexibility, resiliency, complexity, degree of automation, extent of co-production with customers, degree of customizability, and visibility to customers. Many of these characteristics concern more than just the business process because characteristics of work system participants and technologies performing the same business process lead to different degrees of scalability, flexibility, resiliency, and so on.

4 Using a WST Perspective to Extend BPM

In this section, we discuss two ways to use WST to extend BPM. First, we explore additional ideas for the existing six technically oriented categories of BPM use cases that van der Aalst (2013) mentions. Second, we identify novel BPM research use cases in more general areas in which a WST perspective expands the scope of BPM.

4.1 Using WST to Extend BPM Research Use Cases

Van der Aalst (2013, pp. 6-12) organizes 20 BPM use cases in six categories. In this section, we show how a WST-inspired approach addresses some of those topics in the broader and less software-centric context of work systems. Areas of overlap are places where current BPM topics are also work system topics. Areas of non-overlap may provide topics for an expanded form of BPM.

4.1.1 Category 1: Obtaining Models

Both BPM and WST need to define processes and activities. The work system framework (Figure 1) supports a simple type of textual modeling called the work system snapshot (e.g., Table 3) that many hundreds of bachelor, MBA and executive MBA students have used to produce management briefings related to potential improvements of work systems in their own business organizations (Truex, Alter, & Long, 2010; Recker & Alter, 2012; Alter, 2013). This type of non-graphical modeling is useful for clarifying the scope of the work system at the beginning of an analysis and design effort. The basic idea for this type of model is to summarize a work system on one page by identifying its customers, product/services, major activities and processes, participants, information, and technologies. Notice that this type of model does not attempt to specify detailed process logic. Instead, it suffices to summarize the process more or less in the order of activities without great concern about whether some activities occur in parallel. Obviously, more detailed types of modeling will be necessary to specify precise process flows, but that degree of specificity is not necessary for attaining general agreement about the identity and scope of the work system being analyzed.

Table 4 illustrates that the work system metamodel in Figure 2 provides entity types that one can use for more detailed modeling of the same situation that the work system snapshot in Table 3 summarizes. The more detailed model in Table 4 adds some of the information that appears in a typical use case narrative, such as triggers, preconditions, and post conditions for specific activities.

While many managers become overwhelmed in complex diagrams and notations, simple tables of business process steps similar to Table 4 can be used for specific discussions and clarifications. For example, analysts and managers can use tables based on selected columns in Table 4 and possibly columns based on other entity types in the metamodel for clarifying topics and issues that would not be apparent in a work system snapshot. Examples include triggers and preconditions for activities in which customers perform actor roles, activities that use particular types of resources, information used by activities that are performed automatically, and so on. Once again, this level of modeling is useful for clarifying many issues even though it does not attempt to specify the detailed logic of the process flow; that would have to be documented using other tools such as BPMN.

Thus, in relation to the first use-case category (i.e., obtain models), WST and the metamodel may be helpful in producing initial models that may be sufficient for many managerial BPM purposes and that can lead to more formalized process modeling wherever necessary.

We now say a bit more about the potential applications of WST and the related metamodel to each of the use cases in the category “obtain models”. To keep track of the use cases, we reuse the 1 to 20 numbering of use cases that we introduce above.

1) **Design model**. Tables 3 and 4 illustrate types of models that were designed based on WST and the metamodel. The tabular format empowers business professionals, not just BPM experts or researchers, to create and discuss new or improved models.
2) **Discover model from event data**. Applying this use case depends on the existence and scope of event data. For example, if an organization kept records of which resources were used in particular processes or when producing particular product/services, it might be possible to use a more elaborate version of process mining to reconstruct aspects of a work system model by

examining event logs that identify the resources that each event used (not just the events' occurrence).

3) **Select model from collection**. One can pursue this use case in a variety of ways that build on the approach that van der Aalst (2013, p. 7) mentions: "Large organizations may have repositories containing hundreds of process models. There may be variations of the same model for different departments or products. Moreover, processes may change over time resulting in different versions." Any organization that has a repository of process or work system models could use it to find starting points for creating new models or reinventing old ones, which would require a way to search the existing models to find the relevant ones.
4) **Merge models and 5) compose model**. Expanded versions of these two use cases can start from the same type of repository. Assume that only process models existed. Analysts would select and combine relevant process models and then would expand them using whatever entity types in the metamodel are relevant for the purpose at hand. Parts of the initial expansion would require no research for experienced analysts because they could fill in a first approximation to many of the details based on their business experience. The analysts would then check with subject matter experts to verify the initial assumptions. This could be a good way to attain benefit from existing models in a corporate setting.

Table 3. Typical Work System Snapshot of a Hiring Work System (Alter, 2013)

<table>
<tr><th colspan="2">Customers</th><th colspan="2">Product/services</th></tr>
<tr><td colspan="2">• Hiring manager
• Larger organization (which will have the applicant as a colleague
• HR manager (who will analyze the nature of applications)</td><td colspan="2">• Applications (which may be used for subsequent analysis)
• Job offers
• Rejection letters
• Hiring of the applicant</td></tr>
<tr><th colspan="4">Major activities and processes</th></tr>
<tr><td colspan="2">• Hiring manager submits request for new hire.
• Staffing coordinator defines the parameters of the new position.
• Staffing coordinator publicizes the position.
• Applicants submit resumes.
• Staffing coordinator selects shortlisted applicants and sends the list to the hiring manager.
• Hiring manager identifies applicants for interview by browsing applicant resumes.</td><td colspan="2">• Staffing coordinator sets up interviews.
• Hiring manager provides feedback from the interviews.
• Staffing coordinator or staffing assistant sets up additional interviews with other employees.
• Hiring manager makes hiring decisions.
• Staffing assistant sends offer letters or rejections.
• Successful applicant accepts or rejects job offer.</td></tr>
<tr><th>Participants</th><th colspan="2">Information</th><th>Technology</th></tr>
<tr><td>• Hiring managers
• Staffing coordinator
• Applicants
• Staffing assistant
• Other employees who perform interviews</td><td colspan="2">• Job requisition
• Job description
• Advertisements
• Job applications
• Cover letters
• Applicant resumes
• Short list of applicants
• Information and impressions from the interviews
• Job offers
• Rejection letters</td><td>• New HR portal that is being built
• Word processor
• Telephones
• Email</td></tr>
</table>

Table 4. Summary of a Hiring Work System Based on Entity Types in the Metamodel

Activity	Actors	Information used, created, updated, or deleted	Technology	Trigger	Preconditions	Post conditions (including products/services produced)
• Submit request for new hire.	• Hiring manager	• Hiring budget • Job requisition	• HR portal	• Need for new employee	• Sufficient hiring budget	• Job requisition exists
• Define parameters of the job.	• Staffing coordinator	• Job requisition • Job description • Hiring policies	• Word processor • HR portal	• Job requisition	• Job requisition	• Job description
• Publicize the job opening	• Staffing coordinator	• Experience with advertising media • Advertisement	• HR portal, • Web site for selected media	• Job requisition, Job description	• Job requisition, Job description	• Advertisement displayed on websites
• Submit application	• Applicant	• Job description • Cover letter • Job application, • Resume	• HR portal	• Advertisement displayed on websites	• Advertisement displayed on websites	• Receipt of cover letter, job application, resume
• Select shortlist	• Staffing coordinator	• Job application Short list of best applicants	• HR portal	• Deadline for job applications	• Availability of job applications	• Short list available to hiring manager
• Identify applicants to interview	• Hiring manager	• Short list of best applicants • List selected for interviews	• HR portal	• Short list available to hiring manager	• Short list available to hiring manager	• List selected for interviews
• Set up interviews	• Staffing coordinator	• Schedules of interviewers • Interview schedule	• Employee calendar system, • HR portal	• List selected for interviews	• List selected for interviews	• Interviews schedule
• Perform interview	• Hiring manager • Other interviewers	• Job description • Job application • Interview impressions	• HR portal	• Interview schedule	• Interview schedule	• Interview impressions
• Make hiring decision	• Hiring manager	• Interview impressions • Hiring decision	• HR portal	• Completion of interviews	• Completion of interviews	• Hiring decision
• Send offer letters or rejections.	• Staffing assistant	• Hiring decision • Job offer • Rejection letter	• HR portal	• Hiring decision	• Hiring decision	• Job offer, • Rejection letter
• Accepts or rejects job offer.	• Applicant who was selected	• Job offer, • Applicant's response to offer	• HR portal	• Job offer	• Job offer	• Applicant's response to offer

4.1.2 Category 2: Configurable Models

Use cases in this category include 6) design configurable model, 7) merge models into configurable model, and 8) configure configurable model. Pursuing those use cases would occur similarly to pursuing the use cases mentioned under the first category (i.e., obtain models). In the instance of configurable models, however, configuration parameters would receive special attention. For example, tables with the general format of Table 4 could include a column for configuration parameters. Alternatively, in cases with multiple parameters, it probably would be better to use a decision tree or decision table that identifies situations where specific configuration parameters are relevant and that provides links between specific configuration parameters and specific submodels.

4.1.3 Category 3: Process Execution

Van der Aalst (2013, p. 9) states: “the initial focus of WFM systems was on process automation and implementation, and not on the management, analysis, and improvement of business processes”. The related use cases in this category include the following:

9) **Refine model**. From a WST viewpoint, refining a model involves the same types of thinking and methods that are relevant in all of the previous use cases. In other words, refining a model calls for starting with a model specification, finding areas for improvement, and modifying the model accordingly.
10) **Enact model**. The preconditions, triggers, and postconditions in the metamodel (Figure 2) provide a basis for controlling the initiation of activities, which can be done using an "enactment service" that "takes care of control and execution" (van der Aalst, 2013, pp. 15, 17). The enactment service monitors the status of all process or activity instances and initiates work system activities based on the status of each activity's preconditions and triggers. The broader scope of WST and the metamodel (e.g., they explicitly include resources such as customer and noncustomer participants, various types of information, technologies, and other resources) provides a richer basis for defining and evaluating preconditions, triggers, and postconditions. In addition, the metamodel treats business rules as informational resources for executing specific activities. That treatment of business rules goes beyond the typical BPM assumption that the execution of a process step is basically a subroutine that will execute correctly outside of BPM's scope.
11) **Log event data**. The metamodel identifies many entity types that provide a much richer view of event occurrences than is possible from a simple event log that lists only the time that each event occurred for each process instance. The main limitation for a WST viewpoint is the extent to which data is logged (preferably automatically) for the various entity types relevant for each activity.
12) **Monitor.** Similarly, the many entity types that the metamodel identifies provide a much richer view of what actually happens as a process executes in a work system.
13) **Adapt while running**. The metamodel provides several informational entity types that can be adjusted as a way to implement "adaptation while running". For example, executing a particular process step might generate a post condition that calls for changing a business rule either temporarily (e.g., in a bottleneck situation) or over a longer time span. The main challenge for implementing this expanded use case is to identify and test the relevant business rules, triggers, preconditions, and other parameters that might be changed in the adaptation calculations.

The metamodel might be especially valuable for resolving resource conflicts, an extended version of "adapt while running". Coordination theory (Crowston, Rubleske, & Howison, 2006), the theory of constraints (Goldratt 1990), and other techniques related to scheduling and dispatching deal with prioritization related to use of resources and recognize that people and other resources often cannot be involved in two different activities simultaneously. Conflict resolution may occur informally as happens in most operational business processes. In some situations, conflict resolution can be formalized using in business rules in an automated enactment service that controls the execution of processes and activities.

4.1.4 Category 4: Model-based Analysis

BPM use cases in this area include 15) analyze performance based on model and 16) verify model. One can use both work system snapshots (e.g., Table 3) and tables in the general form of Table 4 to analyze performance based on inspection, discussion, and largely manual analysis methods. The work system method (WSM) that we mention above operates in that way. It starts by identifying the smallest work system that has a problem or opportunity. It proceeds by summarizing the "as-is" work system using a work system snapshot, drilling down as needed (e.g., by identifying performance gaps and structural issues related to various aspects of the work system), identifying and analyzing alternative possibilities for improvement, selecting a preferred alternative, summarizing the "to-be" work system, and explaining why its performance will probably be better than the performance of the "as-is" work system.

Thus, WSM addresses some of the issues in use cases 15 and 16 but uses less precise models and data than are generally associated with those use cases. van der Aalst's (2013, p. 10) expresses the general nature of those use cases as follows: "Instead of directly hard-coding behavior in software, models can be analyzed before being put into production". For example, "executable process models can be used to analyze the expected performance in terms of response times, waiting times, flow times, utilization, costs, and so forth".

While WST supports the less precise approach in WSM, its metamodel can serve as the basis of mathematical analysis that not only conforms to general expectations in van der Aalst (2013) but actually could yield more realistic results. Assume that an instantiation of the metamodel provides the basis of an agent-based simulation that includes not only a process specification but also specification of all of the major resources that are required and all preconditions, triggers, business rules, and so on. Multiple runs of the agent-based simulation would consider many factors beyond a process specification, including interactions between factors, such as conflicts between different processes that require the same human or physical resources. The metamodel-informed simulations could use parameters related to any entity types in the metamodel. The simulation analyses would use a version of the enactment service mentioned above. It would be augmented by another process that would feed new cases to the enactment service based on likely statistical distributions of not only the new cases' timing but also their characteristics (e.g., quantities and special requirements of pre-defined types). In addition to estimated timing parameters, the simulation runs could use estimates or distributions of other parameters such as yield percentages, rework rates, and equipment outages. Those parameters would be attached to specific work system activities in processes or could be attached to specific resources (e.g., distribution of skill levels of human participants or distribution of accuracy of information). As Figure 2 notes, those attributes and distributions are not visible in the one-page representation of the metamodel.

4.1.5 Category 5: Extracting Diagnostics from Event Data

Van der Aalst's (2013, p. 10) two use cases in this area include 16) check conformance using event data and 17) analyze performance using event data. The discussion of extracting diagnostics from event data seems to imply that BPM does not include other performance measurement that is essential both for operational management and for explaining variations that might be discovered through process mining.

The metamodel assumes that each execution of a work system activity is an event that changes the status of a particular case or instance and often changes the status of resources that are affected or consumed. A transaction database can record each such event along with information that might be used for subsequent activities and for analyzing important aspects of performance. The transaction database would include a timestamp for each event. It also would provide informational resources for subsequent activities and for after-the-fact analysis by managers. Both requirements call for metrics such as efficiency, resources used, deviations from desired accuracy, rework, error rate, and other forms of waste. Collecting and using whatever execution-related information might be linked to root causes of problems or deviations could provide a much richer version of process mining than analysis based on chains of time-stamped events that contain no other information about event details.

4.1.6 Category 6: Producing New Models Based on Diagnostics or Event Data

The use cases here include 18) repair model, 19) extend model, and 20) improve model. Van der Aalst (2013, p. 10) notes: "diagnostic information and event data can be used to repair, extend, or improve models".

Tracking based on a WST perspective supports a broader version of the same general purpose. The information would be used to repair, extend, or improve work systems through typical management interventions or through automated means. For example, business rules in a service-enactment function could support adaptive modifications of the business rules in a business process.

4.2 Implications of WST for New Use Cases

In addition to extending existing BPM use cases, WST also has implications for new use cases that are outside of BPM's current scope. In this section, we mention possibilities related to processes and customers, processes and product/services, processes and participants, processes and technologies, and processes and workarounds. We do not discuss other conceivable use cases here. Using this paper's numbering convention, we identify the new use cases as follows:

- **Use cases related to processes and customers**, which include 21) designing provider processes from customer processes, 22) merging provider and customer processes, and 23) configuring customer processes based on provider processes.
- **Use cases related to processes and product/services**, which include 24) configure product/service based on process, 25) select process based on product/service, 26) verify product/service based on process (and vice versa), or 27) improve product/service through process improvement.

- **Use cases related to processes and participants**, which include 28) check fit of process to participants (and vice versa), 29) design process for participants, 30) analyze process performance based on participants, or 31) merge processes for benefit of participants.
- **Use cases related to processes and technologies**, which include 32) design process for technology (and vice versa), 33) merge technologies for process, or 34) analyze process by technology.
- **Use cases related to processes and workarounds**, which include 35) identify foreseeable workarounds, 36) design in relation to foreseeable workarounds, and 37) incorporate foreseeable workarounds into documentation.

4.2.1 Processes and Customers

A central concern in the emerging service science discipline involves whether and to what extent a provider's activities can facilitate value for customers (often through co-producing services and even co-creating value) (e.g., Vargo & Lusch, 2008; Grönroos, 2011). Bringing BPM into the entire discussion of operational service systems (i.e., not just service-oriented computing architectures) calls for extending BPM use cases into situations in which both customers and providers perform actor roles in business processes that provide service. Some research has examined private processes as the customer's counterpart (Rosemann, 2014), but a WST-inspired approach would go much further. Possible BPM research use cases include 21) designing provider processes *from* customer processes, 22) merging provider and customer processes, or 23) configuring customer processes based on provider processes. Use case 21 draws attention to the design of operational business processes in explicit alignment with processes enacted by customers outside of the organization. An example would be creating business processes for handling medical insurance claims by drawing on the personalized medical treatment processes encountered by a patient. Use case 22 focuses on the intricate interconnectedness between many contemporary operational business processes in an organization and the much more informal and under-specified processes of customers. Today's network-based businesses such as AirBnB, Uber and others operate in that type of situation. Use case 23 suggests customizing customers' individual, private activities in alignment with the operational processes of a provider; for instance, by providing recommendations for building a house on basis of how an architectural firm operates such projects.

4.2.2 Processes and Products/Services

These research use cases refer to processes and activities that are designed in explicit recognition of the product/services being produced. Existing research on product-based workflow design has attempted at least one related use case: design process model from product (Reijers, Limam, & van der Aalst, 2003). The WST metamodel identifies other relationships between processes and product/services that suggest new research use cases such as: 24) configure product/service based on process, 25) select process based on product/service, 26) verify product/service based on process (and vice versa), or 27) improve product/service through process improvement. Use case 24 calls for formalizing the notion of process-based design that is implicit in approaches such as TRIZ (Savransky, 2000). Use case 25 introduces provider choices between multiple feasible processes based on the product/service offered or purchased. An example is different airport procedures for economy, business, and first class tickets. Use case 26 is supported by some quality management methodologies such as total quality management (TQM) (Powell, 1995) and is based on evaluating or even changing product/service attributes in the design process. Use case 27 explores how product/service improvement can occur through better processes.

4.2.3 Processes and Participants

These research use cases typically focus on reallocating resources to tasks (zur Muehlen, 2004). WST suggests going further by considering participant characteristics in BPM. Potential use cases in this category include: 28) check fit of process to participants (and vice versa), 29) design process for participants, 30) analyze process performance based on participant, and 31) merge processes for participants. All of these use cases assume that fit between the process and the participants matters and, therefore, belongs in the scope of BPM concerns. For instance, use cases 28 and 30 suggest that some processes may better suit participants with particular attitudinal, cognitive, or other personal characteristics (e.g., the way in which participants who require clear direction and guidance may need an abundance of process models to guide their work, while others thrive under conditions of freedom and empowerment). Use cases 29 and 31 address ways in which processes could or should be tailored or combined depending on personal characteristics (e.g., one's ability to multi-task or one's ability to make consequential decisions without extensive rules or frequent management review).

4.2.4 Processes and Technologies

Most BPM use cases say little or nothing about technology used in executing specific process steps even though technology's enablement of profound changes in work practices and business transactions has been a widely recognized business theme in recent decades. A work system's performance depends on all of its components, including technologies. A WST lens suggests BPM use cases related to matching processes and technologies. The research use cases include: 32) design process for technology (and vice versa), 33) merge technologies for process, and 34) analyze process by technology. Use case 32 can be seen to some extent in the adjustment of online offerings based on type of device (e.g., a simpler process for smartphones). Use cases 33 and 34 recognize that the choices among alternative technologies (and availability of shared technological infrastructure) may have a variety of impacts on process design or performance. The related research could identify and evaluate traditional processes that cannot be adapted readily to contemporary technologies. One approach for that research challenge could apply process virtualization theory (Overby, 2008), which asks whether and how to convert information-intensive business processes (e.g., postal mail, banking transactions) to online modes without loss of performance or acceptance.

4.2.5 Processes and Workarounds

The previous use cases focus on combinations of elements in the work system framework. Recent WST extensions suggest several additional use cases related to the frequent occurrence of workarounds, a form of unplanned change that appears in the work system lifecycle model (Figure 1) as a type of unanticipated adaptation. As Alter (2014, p. 1044) states:

> *A workaround is a goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system in order to overcome, bypass, or minimize the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system or its participants from achieving a desired level of efficiency, effectiveness, or other organizational or personal goals.*

Workarounds appear frequently in everyday work practices. Some workarounds are attempts to overcome transient malfunctions or exception conditions that are obstacles to successfully completing work. Others are work system participants' attempts to bypass aspects of business processes that seem cumbersome, over-constrained, or no longer aligned with the realities in hand. Others still are basically deviant behavior that is largely or totally related to personal goals rather than organizational goals. A theory of workarounds (Alter, 2014, p. 1056) identifies factors related to whether and how workarounds are designed and executed.

Despite the frequent occurrence of workarounds, most BPM research to date seems to assume that processes will be executed as designed and that deviances can be identified and eliminated. A more realistic assumption is that conformance to business processes depends on many factors that are only partially knowable in advance and, further, that beneficial workarounds may overcome obstacles to meeting business objectives just as failure to design and execute workarounds may be detrimental to meeting business objectives. Also, notice how some deviances could be improvements to the original process and could form the basis for new process models (Dumas & Maggi, 2015; Recker, 2015).

Potential use cases related to workarounds include 35) identify foreseeable workarounds, 36) design in relation to foreseeable workarounds, and 37) incorporate foreseeable workarounds into documentation. Use case 35 could be pursued through extensions to current analysis and design processes. As a possible starting point for use case 36, a proposed workaround design system (Alter, 2015c) would use previously compiled and organized examples of typical workarounds to make it easier to identify likely workarounds along with conditions under which they would be viewed as beneficial noncompliance or detrimental compliance (Alter, 2015a). Research use case 37 involves developing methods and notations for including likely workarounds in process documentation. Research use cases such as those could be of substantial practical value.

5 Conclusion

We wrote this paper to respond to the disconnect between what BPM means to managers and executives who do not know about BPM software and what it seems to mean to different BPM researchers. We propose a way to move beyond van der Aalst's (2013) view of BPM as focusing on the creation, discovery, use, and management of formal, computerized process models. While process models are a very important research topic where substantial progress continues to occur, a WST-based view of BPM would address current BPM topics along with many management concerns that are currently beyond BPM's scope.

With this paper, we contribute to the BPM literature by describing a WST-based path for expanding BPM's scope. Seeing typical BPM topics in the broader context of work systems rather than just models of business processes potentially makes BPM even more valuable. We show how a WST-based perspective suggests potentially valuable extensions to the 20 existing use cases that van der Aalst (2013) identify. We also identify 17 new use cases that illustrate how a WST perspective suggests pathways toward addressing important issues that are beyond the current scope of technically oriented BPM research. We summarize this paper's main implications as follows. First, managing business processes concerns designing, operating, and improving operational work systems whose human participants, computerized and non-computerized information, technologies, product/services, and customers also must be understood and managed. Otherwise, BPM remains much more about managing process models rather than managing operational business processes.

Second, managing business processes necessarily includes designing, implementing, monitoring, and managing both the sequence of activities and the execution of activities. The related deliberations and communication should recognize the four types of processes we mention above. Ideally, processes should be specified with appropriate degrees of interpretive flexibility—an idea that is consistent with Cherns' (1987, p. 155) principle of minimum critical specification (i.e., "no more should be specified than what is absolutely essential").

Third, a broader version of BPM should consider actual work practices and actual performance results and not just process models. Process mining research is certainly a step in that direction, but it is possible to go much further through BPM research that explicitly recognizes realities of everyday work life, such as:

- Varying degrees of conformance or non-conformance to documented business processes
- Unanticipated exceptions and contingencies
- Variability in human participants' skills and motivations
- Accuracy or inaccuracy of information that business processes use and create
- Reliability or unreliability of technology, and
- Obstacles and uncertainties related to the surrounding environment and the shared infrastructure that work systems rely on.

A WST perspective extends the focus beyond what we see as an unnecessarily limited view of BPM as the management of business process models. Realistically managing operational business processes requires a work system view—or something like it—because managers of operational systems need to understand and manage or respond to every element in the work system framework. Even when BPM software is involved, the focal point for managers is the work system and not just the process model and certainly not just the BPM software. Our WST-inspired extensions of existing use cases and articulation of new use cases could lead to new BPM research topics and new ways to achieve real-world value from BPM.

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About the Authors

Steven Alter is Professor Emeritus at the University of San Francisco. He served as vice president of a manufacturing software start-up that was acquired by Applied Materials. Upon returning to academia, he wrote four editions of a major IS textbook. That effort led to research focused on developing systems analysis and design methods that business professionals could use for their own understanding and to help them collaborate more effectively with IT professionals, consultants, and vendors. The result was various versions of the work system method (WSM), which focuses on the business problem of creating or improving a sociotechnical work system, rather than the more limited technical challenge of creating or improving software that satisfies requirements. Most of his papers in journals and conference proceedings are related to WSM, work system theory (WST), service systems, and extensions of WST such as a theory of workarounds. Most of his papers are available at www.stevenalter.com.

Jan Recker is Alexander-von-Humboldt Fellow and Professor at the QUT Business School. He is presently Editor-in-Chief of the *Communications of the Association for Information Systems*. His research focuses on process analysis and design, digital innovation and environmental sustainability. He has published in the *MIS Quarterly*, *Journal of the Association for Information Systems*, *Information Systems Journal, Academy of Management Discoveries, European Journal of Information Systems,* and others.

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