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A Balanced Perspective on the Bright and Dark Sides of IT Based on a Systems Theory of IT Innovation, Adoption, and Adaptation

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Completed Research Paper

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Abstract

This conceptual contribution explains how a systems theory of IT innovation, adoption, and adaptation provides a balanced perspective on the bright and dark sides of IT. It starts by explaining how the bright and dark sides of IT are often entangled, which implies that variance theories in the style of TAM and UTAUT should have difficulty addressing the bright and the dark in a balanced and useful way. It distinguishes systems theories from variance theories. It proposes an extension of work system theory (WST) in the form of a systems theory of IT innovation, adoption, and adaptation that provides a balanced perspective on the bright and dark sides of IT. It shows how that theory, combined with WST and some of its other extensions, leads to a series of topics and questions that are directly relevant to understanding and analyzing the bright and dark sides of IT.

Keywords: Dark side of IT, work system, IT adoption, IT adaptation

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The Simultaneous Existence of the Bright and Dark Sides of IT

Everyone knows that most types of IT may be used for beneficial purposes and/or detrimental purposes. Almost any story about how IT is used beneficially can be countered with a story of how IT was misused, either accidentally or intentionally. The following five stories all involve IT use. In each case, an intended bright side for some (whether realized or not) is entangled with a possible or likely dark side for others.

> **Surveillance capitalism**. Zuboff's (2015) article on "surveillance capitalism" emphasizes trends toward digitization that lead to systems that have two types of beneficiaries, those who receive and use whatever the system produces as its primary purpose and those who receive and use information generated by or about the system's customers and/or participants. In many cases, both IS uses and corporate customers may be justified in finding the monitoring excessive if not creepy.
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> **Bypassing of password control.** An article called "Workarounds to Computer Access in Healthcare Organizations: You Want My Password or a Dead Patient? (Koppel et al., 2015) referred to "endemic circumvention of password based authentication." ... "We find users write down passwords everywhere. Sticky notes form sticky stalagmites on medical devices and in medication preparation rooms. We've observed entire hospital units share a password to a medical device, where the password is taped onto the device. We found emergency room supply rooms with locked doors where the lock code was written on the door--no one wanted to prevent a clinician from obtaining emergency supplies because they didn't remember the code." Such practices apparently were permitted because the benefits of quicker access for doctors and nurses outweighed the benefits of tighter security and more accurate data for corporate stakeholders.
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> **Overcoming corporate controls**. "Traders, bankers, and money managers are embracing ["encrypted messaging services such as WhatsApp and Signal"] ... to circumvent compliance, get around the human resources police, and keep bosses in the dark." (Keller, 2017). Here the people circumventing compliance saw personal benefit even though the organization or its management might have been harmed by lack of visibility.
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> **Faking pollution tests.** Volkswagen's attempt to maintain profitability by evading pollution control standards might be viewed as an IT innovation that created a widely publicized corporate responsibility scandal. Volkswagen engineers created a computer program that turned on pollution controls during pollution testing for an automobile, but then turned off the controls while automobile was on the road, thereby allowing automobiles to generate excessive pollution even though they seemed to pass pollution tests (White, 2017).
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> **Creating unauthorized customer accounts**. Wells Fargo Bank "clawed back" $75 million of stock options from two former executives who were in charge when excessive sales quotas pressured employees to sell unwanted or unneeded products and in some cases even to open unauthorized accounts (Cowley and Kingson, 2017). A subsequent review found other patterns of wrongdoing, such as inappropriate charges and withholding of refunds. (Cowley, 2017). These examples of malfeasance using IT led to bonuses for the perpetrators and their managers, and sometimes created unauthorized costs for customers.

These cases were chosen to illustrate that someone might experience a bright side, at least temporarily, even in situations that most outside observers would see as representing or being implicated in the dark side of IT. In many more typical situations, the bright side and dark side represent legitimate trade-offs

between preferences of different stakeholders, e.g., between tighter control for better business performance versus personal feelings of being overcontrolled, or between innovation delays due to regulations versus possible prevention of potential damage to people or interests that are not otherwise involved with the innovation.

In relation to adoption and use of IT, these stories can be viewed as revealing the multifaceted and often ambiguous nature of the bright side vs. the dark side of IT. In each case, owners or sponsors of IT were or might have been beneficiaries of actions that created costs, harm, or discomfort for others. In all five cases, the bright or dark impacts and consequences occurred in the context of work systems in organizations. In all cases, aspects of the bright and dark phenomena are directly related to how systems in organizations operate in practice. Thus, the systems themselves had many impacts on the outcomes for different stakeholders, independent of the contribution of IT or the impact of isolated features related to IT artifacts. How those systems operated in practice was related to how those systems evolved over time within business settings. In each case, the use of IT was only part of the story of how a system came to generate benefits or harm for individuals, organizations, or society.

Goal and challenge. The Call for Papers for the DIGIT 2017 workshop highlighted its focus on positive and negative impacts of IT adoption and use. This conceptual contribution addresses that theme by presenting a new systems theory of IT innovation, adoption, and adaptation in the context of operational work systems. In relation to the workshop theme, that theory is useful for visualizing the multi-faceted and sometimes intertwined nature of bright vs. dark sides of IT, which become evident in the way IT enables or disables work systems and thereby contributes to positive or negative outcomes for different stakeholders.

There are significant challenges in trying to explain a systems theory of IT innovation, adoption, and adaptation and then apply it to the bright side and dark side of IT. The first challenge is that variance theories, rather than systems theories, are much more the norm in the IS discipline (see Fichman (2004), Burton-Jones et al. (2015), Grover and Lyytinen (2015), and Demetis and Lee (2016)). For example, some researchers (e.g., Weber (2012), Niederman and March (2014) argue that the only proper theories are Gregor (2006) Type IV theories that contain independent and dependent variables. In contrast, this paper uses the definition of theory from Schatzki (2001) that treats a theory as an abstract account (explained later). A second challenge is that variance theories are the norm in studies of IT innovation, adoption, and diffusion, as will be explained. A third challenge is that this paper covers a lot of territory.

Organization. This paper explains how systems theories differ from variance theories and process theories. It summarizes work system theory (WST), which is the basis of the new systems theory of IT innovation, adoption, and adaptation in organizational settings. It presents a stage model of IT innovation. It links that stage model to the work system life cycle model, which is the part of WST that focuses on how work systems change over time. With those ideas in place, this paper shows how the new systems theory helps in understanding the bright and dark sides of IT.

What Are Systems Theories?

The section summarizes general differences between systems theories and variance theories that predominate in studies of IT adoption and adaptation. Based on those differences, it defines the term systems theory and summarizes how a systems theory can be used for analysis and synthesis.

The dominant paradigm in IT innovation research. More than a decade ago, Fichman (2004, p. 315) described the "dominant paradigm" used in most research on IT innovation [as of 2004] as a variance perspective, which Burton-Jones et al. (2015) differentiate from a process perspective and a systems perspective. The dominant paradigm is "typified by the desire to explain innovation using economic-rationalistic models, whereby organizations that have a greater *quantity* of what might be called "the Right Stuff" (i.e., greater innovation-related *needs* and *abilities*) are expected to exhibit a greater *quantity* of innovation (i.e., greater frequency, earliness, or extent of adoption). A footnote (p. 315) observes that Abrahamson (1991) argued that an efficient-choice perspective similarly dominated diffusion research. Much of the research within three broad contexts of IT adoption and diffusion has used Fichman's factor-oriented dominant paradigm. 1) Research about antecedents and correlates of adoption produced TAM, the technology acceptance model (Davis et al., 1989), and UTAUT, the unified theory of acceptance and use of technology (Venkatesh et al., 2003). 2) Research on antecedents and

correlates of continued use produced articles such as Karahanna et al. (1999), Bhattacherjee (2001), and Limayem et al. (2003). 3) Research on the evolution of post-adoptive practices produced articles such as Ahuja and Thatcher (2005), Jasperson et al. (2005), Lee et al. (2009), and Sorgenfrei et al. (2014).

The inherently reductionist variance approach of focusing on relationships between variables rather than holistic or systemic issues tends to assume that characteristics or variables have continuous effects on other variables. Beyond that, the general idea of using reductionist approaches has elicited a variety of criticisms related to organization research in general and innovation research in particular. For example, Sinha and van de Ven (2005) speaks of a "reductionist quagmire" and said that "reductionist research methods that have been used to analyze the external fit between context and design variables one at a time should be abandoned. (p. 399). Svahn and Henfridsson (2012) compares traditional product innovation logic with a "competing *logic framework for understanding digital technology in product innovation management." (p. 1)* …. "Seeing design as an emergent process is largely incompatible with a reductionist perspective on complexity." (p. 6). Ramiller and Swanson (2009) examines the "variables-centered" research paradigm, which focuses its attention on covariance among independent and dependent variables." …. "Unfortunately, the variables-centered paradigm appears to distance researchers from the organizational actors, such as managers, to whom they would give advice and counsel. Particularly disturbing is the systematic erasure of those very actors from the domain of inquiry. Erased, too, are their actions and means of acting" (p. 474).

A call for systems theories as a step toward taking systems seriously. In a recent article that proposed requirements for systems theories in IS, Demetis and Lee (2016, p. 116) say that "the academic discipline of information systems, in incorporating the word "systems" in its name ... needs to take 'systems' seriously." They claim that with only a few exceptions, the IS discipline "has not availed itself of the rich intellectual heritage of systems science."

Their approach to incorporating systems more fully starts with general systems properties and distinguishes systems theorizing from positivist theorizing. First, "systems theorizing breaks outside of the boxes-and-arrows depictions to which much positivist IS research is beholden, ... where the boxes denote variables and the arrows denote causal relationships between them, where the arrows may point in only one direction between each pair of variables." Second, "positivist IS research regards alternative ways of explaining the same phenomenon to be competing explanations or competing theories, of which at most one may survive as the right one, whereas systems theorizing (through its feature of equifinality) routinely accepts such alternatives as pathways carved out by different observers." Third is the difference between analysis and synthesis, whereby "systems theorizing is marked by synthesis." Its goal "is not to break down (as in an analysis), but to build up and combine ... to understand the resulting whole." Note that Demetis and Lee (2016) associate positivist theorizing with the use of a variance perspective. In contrast, Burton-Jones et al. (2015) speak of variance, process, and systems perspectives and note that positivist approaches often are associated with variance theories but may apply to other types of theories as well.

Demetis and Lee's characterizations imply that a systems theory might be better suited than a variance theory for understanding the bright side and dark side of IT. A systems theory would be more likely to support meaningful discussions of relevant phenomena in the context of the systems where they occur. A variance theory probably would need to treat bright side and dark side phenomena separately to avoid masking positive and negative effects through averaging. The resulting models with many variables and relationships would be difficult to apply to co-existing bright side vs. dark side phenomena in real situations.

What is a systems theory? A definition of systems theory unfortunately relies on the definition of theory, a topic has been discussed extensively but inconclusively in the IS discipline and in social science, e.g., Markus and Robey 1988; Sutton and Staw 1995; Weick 1995; Gregor 2006; Colquitt and Zapata-Phelan 2007; Weber 2012; Straub 2012; Avison and Malaurent 2014; Grover and Lyytinen 2015. In the IS discipline, a central issue is whether proper theories necessarily are variance theories stated in terms of independent and dependent variables. Addressing that topic in a general way, Gregor (2006) identifies five different types of theory, theories for analysis (I), for explanation (II), for prediction (III), for explanation and prediction (IV), and for design and action (V). The systems theories discussed later are primarily of Type I, although they or their extensions can have direct implications for theories of other types.

Demetis and Lee (2016, p. 118) identifies three characteristics of systems theorizing that are mentioned above but does not define the concept of systems theory and does not provide specific examples of systems theories. Lack of a definition of systems theory makes it unclear whether systems theories can fall into any or all of Gregor's five categories.

This paper defines systems theory based on Schatzki's (2001, pp. 12-13) very general view of theory related to social phenomena, "social things," and sociality. By that view, "theory means, simply, general and abstract account. A theory of X is a general and abstract account of X. [Theories include] typologies of social phenomena; models of social affairs; accounts of what social things (e.g., practices, institutions) are; conceptual frameworks developed expressly for depicting sociality; and descriptions of social life – so long as they are couched in general, abstract terms." Schatzki's definition can be specialized as follows:

> A *systems theory* of X is an abstract account of X that might take a variety of forms such as typologies, conceptual frameworks, models, metamodels or other descriptions or propositions developed expressly for depicting systems or systems phenomena within its domain.
>
> System phenomena are related to the system nature of the systems, which is associated with properties that apply to systems, such as:
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> - interactions or relationships between components,
> - interactions or relationships between a system and its environment,
> - capabilities related to obtaining or receiving inputs from a system's environment,
> - transformations that create outputs transferred outward to a system's environment,
> - regulation of a system's operation,
> - maintenance of a system's capabilities,
> - system responses to internal and external conditions that change over time
> - existence of subsystems and supersystems.

A systems theory defined in that way can support the four steps in Laszlo and Krippner's (1998, pp. 56-57) method for analysis and synthesis based on a systems approach.

- **Embedded context**. "Identify the 'embedding context' and phenomena under consideration."
- **Sub-wholes**. Describe "'sub-wholes within the embedding whole': identifiable discrete entities existing on their own right within the larger framework of the overall ensemble."
- **Specialized parts**. Look at "specialized parts within the identifiable wholes, with emphasis on understanding the structures, their compositions and modes of operation."
- **Integration of the results of the previous steps**. Refocus "on the embedding context, integrating the perspective obtained at each of the preceding steps in an understanding of the overall phenomenon, including its internal and external context."

This paper will present a new systems theory that supports a systems approach for describing the bright side and the dark side of IT. The new theory is based on work system theory, which itself is a systems theory.

Work System Theory

This paper's approach to IT adoption and use is based on work system theory (WST). Sociotechnical researchers have used the idea of work system for decades (e.g., Trist, 1981. Sinha and Van de Ven 2005, Mumford, 2006). That term appeared in the first edition of *MIS Quarterly* (Bostrom and Heinen, 1977). More recently, it was described as the basis of WST (Alter, 2013), which defines that term in a way that includes both sociotechnical and totally automated systems.

Work system. A work system is a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce specific

product/services for specific internal and/or external customers (Alter, 2013). Most significant work systems use IT extensively and can be described as IT-reliant. Enterprises that grow beyond a largely improvised start-up phase can be viewed as operating based on the internal activities and interactions of multiple work systems. For example, typical business enterprises contain work systems that procure materials from suppliers, produce products, deliver products, find customers, create financial reports, hire employees, coordinate work across departments, and perform many other functions. Notice also that supply chains can be viewed as sets of interacting work systems that exist across different enterprises.

The definition of work system includes the phrase "human participants and/or machines perform work" because work systems may be sociotechnical systems with human participants or totally automated work systems. On-going trends toward automation of work and highly computerized work practices imply that focusing exclusively on sociotechnical work systems is insufficient now and in the near-term future.

Information systems. An information system is a type of work system most or all of whose activities focus on processing information, i.e., capturing, transmitting, storing, retrieving, manipulating, and/or displaying information. As with work systems in general, information systems may be sociotechnical systems or totally automated systems.

Work system theory. A complete understanding of a work system needs to include both a static view of a work system during a period when it is relatively stable and a dynamic view of how a work system changes over time. WST (Alter 2013) distills the core of that assumption into three components, the definition of work system (above) and two frameworks that will be explained next.

Work system framework. Figure 1 identifies and organizes nine elements of even a rudimentary understanding a work system's form, function, and environment during a period when it is relatively stable. A work system's identity remains unchanged during such periods of stability even though incremental changes such as minor personnel substitutions or technology upgrades may occur within what is still considered the same version of the same work system. Processes and activities, participants, information, and technologies are viewed as completely within the work system. Customers and product/services may be partially inside and partially outside because customers often participate in the processes and activities within the work system and because product/services take shape within the work system. Environment, infrastructure, and strategies are viewed as largely outside the work system even though they often have direct effects within the work system.

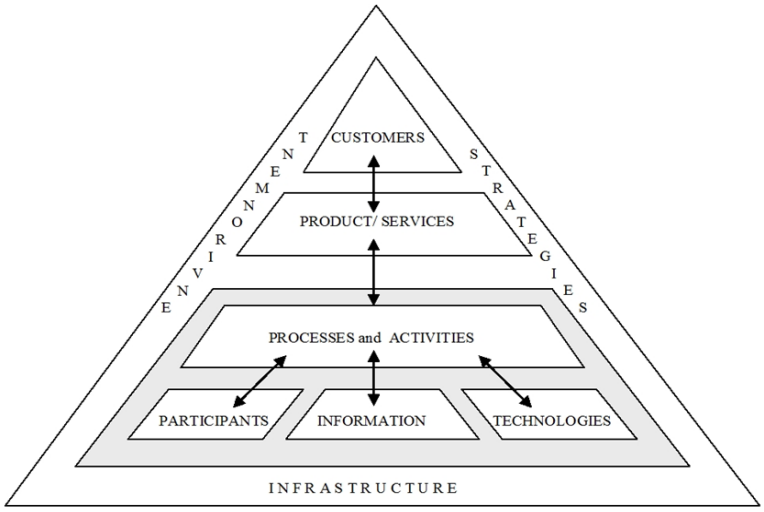

Figure 1. Work System Framework (Alter, 2006, 2013)

Figure 1 places the customer on top because work systems exist for the purpose producing product/services for customers. This leads to trade-offs between internal management concerns about performing the work efficiently, maintaining participant morale, and minimizing vulnerability to threats, versus customer concerns about the total cost, quality, and other characteristics of the product/services that they receive.

The arrows inside the work system framework say that the specific elements of a work system should be in alignment. For example, the knowledge, skills, interests, and motivation of the participants should fit with the processes and activities within the work system. Conversely, the processes and activities should be appropriate for attributes of the participants. Changes in the processes and activities may require related changes in the participants ranging from additional training or new incentives all the way through changing participant roles, replacing some participants with others, or automating parts of the work, thereby rendering some roles unnecessary. Similar alignment issues apply for all pairs of elements that are linked by arrows.

Work system life cycle model. The work system life cycle (WSLC) model (Figure 2) is a pictorial representation of the iterative process by which work systems evolve over time through a combination of planned change (formal projects) and unplanned (emergent) change that occurs through adaptations and workarounds. Those changes involve not only changes in hardware and software, but also changes in all other components of a work system. The WSLC represents planned change as projects that include initiation, development, and implementation phases. Initiation is the chartering of a project whose goal is to create or improve a work system. Development involves creation or acquisition of resources required for implementation of desired changes in the organization. Development may include any of the following: software development, software acquisition, software configuration, creation of new procedures, creation of documentation and training materials, and acquisition of any other resources needed for implementation of the new version of the work system. In contrast with the view of implementation in many software development methods, implementation in the WSLC refers to implementation in the organization, not implementation of algorithms on computers. A full iteration from one operation and maintenance phase to the next operation and maintenance phase might be viewed as a transition from a previous version of the work system to a subsequent version.

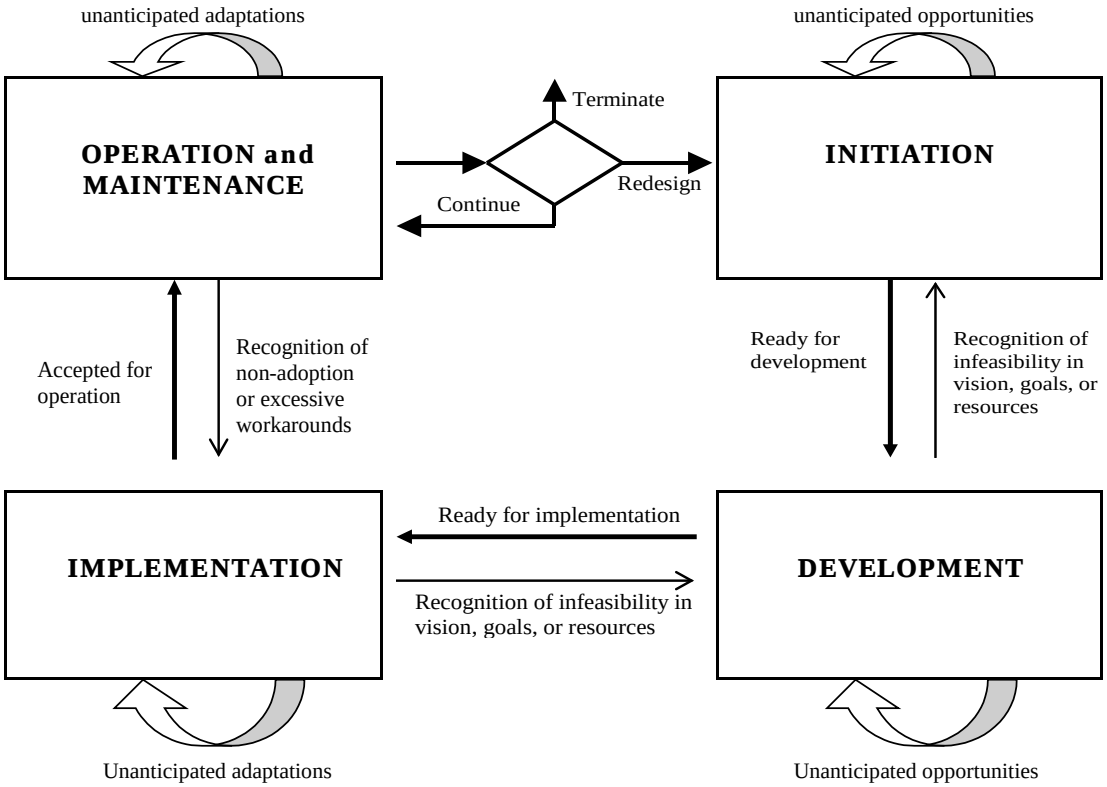

Figure 2. The Work System Life Cycle Model

The WSLC represents unplanned change using inward-facing arrows that represent ongoing adaptations, bricolage, and workarounds that change aspects of the current work system without separate allocation of significant project resources. The inward facing arrows for all four phases of the WSLC emphasize that unplanned change occurs not only through incremental changes in operational systems, but also through changes that occur within different phases of formal projects. The inward-facing arrow for the operation and maintenance phase starts with short term adaptations and workarounds of cumbersome processes. It also includes longer term changes in practices or goals that occur as adaptations and workarounds are incorporated into organizational routines (e.g., Feldman and Pentland, 2003) without requiring formal projects. Unplanned change during the initiation phase may lead to goals that were not initially anticipated; unplanned change during the development phase may lead to new understandings and new combinations of functions and issues that were not anticipated in the initiation phase; unplanned change during the implementation phase may lead to modifications of initial intentions concerning important aspects of the "to be" work system, including process and activity patterns, uses of technology and information, and expectations related to responsibilities and activities of work system participants. A theory of workarounds (Alter, 2014) and a discussion of beneficial noncompliance and detrimental compliance (Alter, 2015) explain more about how and why workarounds and noncompliance occur.

The WSLC is not meant as a rigorous specification of a precise process by which work systems evolve over time. Instead, it summarizes the fact that work systems evolve over time in an iterative manner, that planned and unplanned change are part of the story, that planned change occurs through projects to which resources are assigned, and that unplanned change may occur in a variety of ways. The WSLC is equally relevant to waterfall and agile methods. In waterfall approaches, the phases are separated in a formal way and usually include specified steps within phases of the WSLC. In agile approaches, development and implementation overlap to some extent but are still worth considering because they raise the question of whether completion of each sprint represents implementation of software on a computer versus implementation of a new version of an operational work system.

Stages of IT-Enabled Work System Innovation

An attempt to consider IT innovation in the context of work systems and the WSLC led to the following stage model of IT-enabled work system innovation. As noted below, each of the stages can be related to one or more of the phases in the WSLC in Figure 2.

Stage 1, impetus. Opportunities, performance gaps, or other conditions present needs that inventions may answer. The inventors could be work system participants, managers, or external parties in a product/service ecosystem. During the WSLC's *operation and maintenance phase,* the impetus for innovation often occurs through measurable performance gaps or through incidents that caused significant operational problems. Significant workarounds also may form the impetus. The impetus can come from the other phases as well. Management might initiate a project in the *initiation phase* based on beliefs related to opportunities. During the *development phase,* work analysts and developers might recognize a need that calls for new ways to use IT beneficially. During the *implementation phase,* work system participants might see a need for features or capabilities that are missing from whatever is being implemented.

Stage 2, invention. This is the creation of a new idea, device, or work practice before it is used and/or field-tested in real world settings. An invention may exist in an inventor's mind, may exist as a formal specification, or may have been created and tested in a laboratory or developmental setting. As with the impetus stage, the invention stage can occur during or across any of the four WSLC phases based on mechanisms mentioned above. An invention through planned change occurs when managers initiate a project (*initiation phase*) and allocate resources to create an improved version of an existing work system, possibly, but not necessarily using new or improved IT capabilities. Inventions can occur during *development* and *implementation*, as mentioned above. An invention through unplanned change occurs as adaptations and workarounds allow work system participants to perform their work despite obstacles that they encounter, and sometimes despite inadequacies of available IT.

Stage 3, implementation. This is the process of bringing an invention into use in real world settings. This process may be smooth in some cases, but also may prove controversial or even unpleasant if the invention does not fit needs perceived by potential users, if they or their managers do not understand the

invention, or if they simply don't like it. The literature of change management in organizations addresses these issues most directly. Product development and diffusion literature that takes a producer or vendor's viewpoint is not as relevant to the organizational implementation focus of this stage. Most implementation efforts related to planned change occur during the *implementation phase* of the WSLC. Less visible implementation efforts occur during adaptations and workarounds (Alter, 2014) during the *operation and maintenance phase.*

Stage 4. Post-implementation improvement occurs when shortcomings of a previously implemented innovation become evident. Some of the research cited earlier focused on post-implementation improvement. Most inventions that are implemented in real world settings are improved after initial implementation because the initial invention often addresses some issues in the setting but not others. Work practice innovations based on IT-related inventions often evolve gradually as work system participants gain deeper understanding of how to do the work more efficiently or effectively. Many post-implementation improvements take the form of adaptations or workarounds. Other post-implementation improvements are basically incremental changes, such as moving to a new version of existing hardware and/or software that differs from whatever had been implemented previously.

Stage 5. Routine operation. This stage is reached when the innovation is taken for granted as part of established work practices. In the WSLC this occurs when implementation is complete and the new work system operates routinely. At this point, the innovation is seen less and less as an innovation as it becomes integrated with organizational routines (Feldman and Pentland, 2003). Consistent with that research stream, the inward-looping arrow in the *operation and maintenance phase* of the WSLC says that routine operation is not an end-state because post-implementation improvements continue, either as ongoing adaptations and workarounds or when new formal improvement projects are initiated.

A Systems Theory of IT, Adoption, and Adaptation

A new systems theory of IT innovation, adoption, and adaptation integrates the work system framework, the four phases of the WSLC, and five stages of IT-enabled work system innovation. The theory has six related parts, each of which will be applied later for visualizing the bright side and dark side of IT.

- **A work system as the entity that is adopted, adapted, or improved**. IT innovation, adoption, and adaptation in organizational settings occur within work systems. The adoptive entity is not a hardware/ software configuration, but rather a new or improved work system that incorporates an IT innovation. IT innovations matter to IT users mainly in relation to obtaining better work results in terms of efficiency, effectiveness, quality, speed, reliability, and other aspects of performance.
- **Elements of the work system framework as drivers and obstacles to change**. Each of the nine elements of the work system framework (Figure 1) is associated with widely observed drivers and obstacles to IT innovation, adoption, and adaptation.
- **Stages of IT-enabled work system innovation**. IT innovation in organizational settings can be viewed as IT-enabled work system innovation. It goes through five stages: impetus, invention, implementation, post-implementation improvement, and routine operation. Each stage can occur within one or more phases of the WSLC (Figure 2).
- **Multiple, sometimes contradictory evaluations of the same IT innovation**. In practice, IT innovations implemented in organizations are evaluated from business and personal viewpoints that may or may not be aligned and sometimes may be mutually contradictory. From a business viewpoint, the primary criterion for evaluating IT-related innovations that are perceptible by work system participants involves the innovation's positive or negative contributions to the work system's operation and success. This implies that an IT innovation's contributions to the work system's operation and success is more important to users and managers than its technical features or potential affordances. Simultaneously, evaluations by individuals or groups in relation to personal concerns or interests may involve individual or group concerns or interests that may or may not conform with interests of the enterprise, as when an IT innovation makes existing job skills obsolete.
- **Needing, understanding, and liking as three catalysts of innovation**. Within each phase of the WSLC, needing, understanding, and liking the innovation can be seen as three catalysts of innovation, adoption and/or adaptation. (e.g., greater perception of need increases the likelihood of adoption). Each catalyst can operate at three levels: 1) at the individual level (by affecting acceptance

vs. resistance), 2) at the level of management vs. employee (related to agreement or disagreement for each catalyst), and 3) at the group or organizational level (related to business impacts and benefits).

- **Occurrence and impacts of compliance, noncompliance and workarounds**. In regard to an IT innovation, compliance, noncompliance, and workarounds may occur in any phase of the WSLC. Compliance, noncompliance, and workarounds all can have both positive and negative impacts.

Notice how this is a systems theory in the sense of Schatzki (2001). The domain (the area of relevance) is IT innovation, adoption, and adaptation in a work system setting. The theory itself is an abstract account that includes typologies and models of relevant systems phenomena, accounts of system entities, and conceptual frameworks and descriptions developed expressly for depicting relevant systems phenomena. This theory is quite different from variance theories and from most process theories.

This systems theory is designed to express a plausible and understandable systems view of many phenomena related to IT innovation, adoption, and adaptation. It should be evaluated based on whether its application to situations within its domain suggests important topics to consider and leads to useful insights. Its design did not attempt to explain relationships between variables, as would be present in the variance theories that dominate research on IT innovation, adoption, and adaptation. Parsimony was considered to some extent by trying to avoid redundancy, but it is certainly possible that simpler or more complicated systems theories related to the same domain might prove more useful. In effect, this proposed addition to systems theories in the IS discipline could be viewed as step toward addressing theory-related challenges implied by Demetis and Lee (2016) and possibly by Grover and Lyytinen (2015).

How the New Systems Theory Illuminates the Bright Side and Dark Side of IT

All six parts of the new systems theory could be explained in substantially more detail in a paper focused solely on that theory. Since the DIGIT 2017 workshop CFP requested contributions related to the bright side and the dark side of IT, the remainder of the paper will attempt to combine two goals: first, explaining the theory in a bit more detail and second, explaining some of its implications for the bright and dark sides of IT. This approach tests the theory to some extent by showing that is based on a coherent set of ideas and that it points to significant topics and issues related to the bright side and dark side of IT.

A Work System as the Entity that is Adopted, Adapted, or Improved

The new theory starts by saying that IT innovation, adoption, and adaptation in organizational settings occur within work systems. The adoptive entity is not a hardware/ software configuration, but rather a new or improved work system that incorporates an IT innovation. IT innovations matter to IT users mainly in relation to obtaining better work results in terms of efficiency, effectiveness, quality, speed, reliability, and other aspects of performance.

This view of IT innovation, adoption, and adaptation is quite different from more typical approaches that see the adoptive entity is an IT artifact, essentially a configuration of hardware and/or software. Views of IT-related change coming from that perspective tend to focus IT-centric variables such as perceived usefulness, perceived ease of use, and technology quality (often called system quality in those discussions).

This view of IT innovation, adoption, and adaptation does not apply to innovations in IT products from the perspective of firms that sell those products, e.g., a software vendor's perspective on a software innovation that makes its products more desirable to its customers. Traditional studies of the diffusion of innovative products, e.g., studies based on the Rogers diffusion curve, focus on that type of situation much more than on how new IT products are incorporated into work systems in organizations.

Implications regarding the bright side and dark side of IT. The IT-enabled change in the work system may be beneficial to some stakeholders and harmful or detrimental to others. For example, in an innovation related to surveillance capitalism (mentioned earlier) the bright side is better customer information for corporations and possibly better ability to customize both marketing and product/service offerings to the needs of specific customers. The dark side is unwanted visibility and loss of control of personal information for customers or other citizens. IT innovations that support tight monitoring of employees provide management a bright side of better visibility and while sometimes threatening

employees with a dark side that leaves them with feelings of being micromanaged by Big Brother. IT innovations that improve a firm's product/services have the bright side of supporting better offerings for customers and improving that firm's competitive position, while simultaneously bringing the dark side of harming the competitive position of other firms.

Those bright and dark side examples were stated in a way that exhibits both sides under today's business norms. There are other examples where an IT innovation has benefits for most stakeholders and few dark sides for anyone. From the opposite direction, there are other examples where an IT innovation is designed for attacking a work system, e.g., malware that disrupted the operation of Iranian centrifuges that were used to concentrate isotopes of uranium. That IT innovation was designed to have a bright side for enemies of Iran and a dark side for Iran itself.

This paper's discussion of implications for the bright side versus dark side of IT takes a largely rationalist stance, whereby the benefits may be shared by all stakeholders, may be distributed unevenly, or may provide benefits for some that causes direct harm to others. That type of rationalist view sometimes ignores moral and ethical issues involving topics ranging from seeking unfair advantage over others to inflicting unjustified harm. Moral and ethical issues are quite important, but are beyond this paper's scope.

Elements of the Work System Framework as Drivers and Obstacles to Change

Each of the nine elements of the work system framework (Figure 1) points to widely observed drivers or obstacles to IT innovation, adoption, and adaptation. Table 1 lists some of the typical obstacles and drivers based partly on many hundreds of management briefings produced by MBA and Executive MBA students used (Alter, 2006, 2013). Many other drivers and obstacles to change could have been listed.

Element of the work system framework	**Drivers of change related to IT directly or indirectly**	**Obstacles to change related to IT directly or indirectly**
Customers	• Unmet needs of internal or external customers • Customer dissatisfaction • Agreement about unmet needs of customers	• Satisfied customers • Customer policies or practices that conflict with the change • Disagreement about unmet needs of customers
Product/ services	• Inadequate product/service performance regarding cost to the customer, quality, reliability, speed, customizability, complexity, or other characteristics	• Difficulty in producing fundamentally improvements in product/services with available resources
Processes and activities	• Inadequate performance of processes and activities regarding production cost, efficiency, effectiveness, etc. • Inadequate structure of processes and activities.	• Adequacy of the existing processes and activities • Lack of information about the performance of processes and activities • Lack of knowledge about how to improve processes and activities
Participants	• Knowledge and skill of participants enabling new ways to do work • Motivation and ambition	• Resistance to change • Lack of motivation and ambition
Information	• Inadequacy of existing information that is used in performing processes • Availability of previously unavailable knowledge or information	• Adequacy of the existing information • Inadequate knowledge and information that would facilitate change

Technologies	• Availability of technology innovations that enable new ways of working	• Adequacy of existing technologies in terms of cost, maintainability, and reliability. • Difficulty switching from current technologies to new technologies
Environment	• Changes in aspects of the surrounding environment such as competitive pressures, recent enterprise history, demographics, and so on.	• Organizational culture that resists change • External polices and regulations that prevent or delay changes
Infrastructure	• Availability of infrastructure that facilitates change	• Infrastructure inadequacies that make change more difficult
Strategies	• Alignment of enterprise, department, and work system strategies	• Disagreement about strategies • Misalignment of strategies across levels

Table 1. Elements of the work system framework as drivers and obstacles to change

Implications regarding the bright side and dark side of IT. Every driver and obstacle in Table 1 can be linked in some way to the bright side and/or dark side of IT for specific stakeholders. For example, customer dissatisfaction can lead to IT innovations that provide better product/services (the bright side). However, customer dissatisfaction also can lead to uses of IT that are inappropriate or are not adequately tested (the dark side). Participant knowledge, skills, and motivation can lead to new ways of using IT beneficially (the bright side). However, similar knowledge and skills combined with inappropriate motivations can lead to uses of IT that are harmful or illegal (the dark side – as in examples in the introduction). Overall, nothing about work systems in general says they tend to the bright side or the dark side. Every element of the work system framework can be a source of bright side or dark side outcomes.

Stages of IT-Enabled Work System Innovation

All five stages of IT-enabled work system innovation can contribute to IT's bright side or to its dark side.

- **Impetus**. The impetus for an IT innovation can be based on the best of intentions (the bright side) or can be motivated by greed or criminal intent (the dark side).
- **Invention**. A new IT-related idea, device, or work practice that has not yet been field tested may aim at totally beneficial outcomes (the bright side) but also may be aimed at inappropriate goals that may or may not be hidden from others in the organization (the dark side).
- **Implementation**. The implementation of an IT innovation may contribute to better business performance (the bright side) or may absorb time and effort without producing desired improvements (the dark side).
- **Post-implementation adaptations**. These adaptations may generate better results (the bright side) or may cause problems for some participants or other stakeholders (the dark side).
- **Routine operation**. The work system's routine operation may meet or exceed expectations (the bright side) or may prove inadequate or disastrous for some participants or other stakeholders (the dark side).

Multiple, Sometimes Contradictory Evaluation of the Same IT Innovation

In practice, IT innovations are evaluated from multiple business and personal viewpoints that may be mutually contradictory. The same IT innovation may be highly beneficial for some stakeholders and harmful for others.

In relation to evaluation of IT innovations, a more interesting issue than the bright versus dark sides of IT involves the multiplicity of goals that are relevant for many work systems and hence for many IT innovations that change those work systems. A paper related to service system axioms (Alter, 2017)

addresses that issue through two of 25 service system axioms shown here (and stated in terms of work systems instead of service systems) to indicate that this idea has been developed further. (Service systems are work systems; most work systems are service systems.)

The Goals axiom. "The form, characteristics, and operation of a work system's components affect attainment of multiple goals related to the work system as a whole, related to its components, and related to whatever it produces for its beneficiaries." Most work systems have many goals, such as goals for operational costs, quality of outputs, and satisfaction of users. Work systems goals may include precise outcomes such as "99.9% uptime" and/or soft goals (Yu and Mylopoulos, 1994; Soffer and Wand, 2005) such as "keeping management informed." Work system management calls for identifying, prioritizing, and reconciling diverse goals such as providing timely information, a satisfying customer experience, low operating costs, acceptable uptime, and so on. Thus, the common research assumption that systems have a single goal is often insufficient for understanding how it operates and for managing it. Constructing a single goal through mathematical combination of various performance metrics tends to hide management information that may be important.

The trade-offs axiom. "Conflicts between internal work system goals and goals of various beneficiaries and stakeholders lead to implicit or explicit trade-offs." Goal conflicts stem from divergent goals related to work system components and related to interests of beneficiaries and stakeholders. For example, a work system manager's efficiency and employee satisfaction goals may be quite distant from a beneficiary's goals related to the form, operation, and quality of product/services that the work system produces. Similarly, a work system's internal efficiency goals may conflict with its customer satisfaction goals if greater efficiency calls for devoting fewer resources to interactions and services that customers appreciate. Thus, whatever is declared to be "the goal" or "the goals" of a work system usually is based on implicit or explicit trade-offs. In many situations, other designers or managers might have preferred different trade-offs.

Needing, Understanding, and Liking as Three Catalysts of Innovation

Within each phase of the WSLC, needing, understanding, and liking the innovation can be seen as three catalysts of innovation, adoption and/or adaptation. The verb forms *needing*, *understanding*, and *liking* are used here instead of psychological terms such as an affective, rational, or technology-related terms such as perceived ease of use. The verb forms are used because they express the ideas in a more direct way in relation to IT innovation, adoption, and adaptation in organizational settings.

Needing. This is the extent to which individuals or groups perceive that they need an IT innovation for achieving their own goals. Greater perception of need usually leads to greater support of an innovation.

Understanding. This is the extent to which individuals or groups understand how an innovation can (or cannot) be applied and how and why it might (or might not) be beneficial. Greater understanding may or may not be associated with acceptance or rejection of an IT innovation. The simplest cases are when people accept an innovation because they understand its genuine benefits, or when they reject it because they understand its lack of benefits. Other possibilities are important in some cases. People who understand an IT innovation's beneficial impact for an enterprise still might reject it because its use would conflict with personal or group goals or interests. (Remember the Luddites.) Similarly, people who misunderstand an IT innovation might accept it because they do not appreciate its negative implications for them or their group.

Liking. This is the extent to which individuals or groups like an IT innovation. It is easier to implement IT innovations that are liked. It is possible to implement IT innovations that are disliked, but often with more difficult implementation efforts.

The three catalysts expand on process-oriented ideas in the WSLC and the stages of IT-enabled innovation. Needing, understanding, and liking are closer to the details of whether and how people become committed to planned change projects and unplanned adaptations or workarounds.

Implications regarding the bright side and dark side of IT. Said in a simple way, the bright side is more likely when all or most stakeholders believe there is a need, understand how an IT innovation should help, and like the innovation itself. Dark side issues can appear in many ways, such as the following:

- Stakeholders understand the need at the enterprise or group level, but believe that an IT innovation will have negative consequences for themselves and/or for their colleagues.
- Stakeholders think about the proposed IT innovation superficially and do not recognize that a seemingly beneficial innovation will cause significant problems or is likely to fail.
- Stakeholders disagree about whether an IT innovation is needed, understand the IT innovation in quite different ways, and cannot resolve their disagreements in a manner that is beneficial for the enterprise or for groups or individuals.
- Management and workers have conflicting interests that are exacerbated by an IT innovation which may result in changes in work conditions, requirements for different skills, or even layoffs.

Overall, consideration of the catalysts comes back to the points made earlier. The existence of multiple stakeholders challenges the meaning of the bright side versus dark side of IT because different stakeholders with different interests and goals may have different or even mutually conflicting criteria.

Occurrence and Impacts of Compliance, Noncompliance and Workarounds

Compliance, noncompliance, and workarounds may occur in any phase of the WSLC and can have positive or negative effects wherever they occur. It might seem strange to say that compliance can have negative effects, but compliance to inappropriate processes or rules often is not helpful. Processes and rules sometimes are over-specified to the point that people cannot work productively if they follow every rule. Unions sometimes exploit that phenomenon through an industrial action called "working-to-rule", whereby union members perform only tasks mentioned explicitly in their contract. An example of working-to-rule occurred in several work-to-rule campaigns in Ontario, Canada. "Typical duties withdrawn include[d] running extracurricular activities, meeting with parents, or attending administrative meetings" (Johnson, 2011). In that case, the teachers satisfied their contract but did not fulfill their normal responsibilities. (Alter, 2015). Similarly, there are many cases where noncompliance is beneficial, as in workarounds related to unrealistic processes, unduly restrictive controls, inadequate hardware/software, and malfunctions and temporary obstructions,

The entire topic of workarounds is intertwined with compliance versus noncompliance, but is not identical because there many cases in which workarounds occur without any significant issues about compliance versus noncompliance. A workaround can be defined as "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." A theory of workarounds says that workarounds occur through a process somewhat parallel with the five stages of IT innovation mentioned earlier, whereby someone perceives the need for a workaround and decides whether to pursue a workaround, and if so, how to proceed, based on a combination of factors including the organization's goals, the obstacles at hand, the monitoring system, the reward system, and that individual's ability to produce the workaround (Alter, 2014).

Implications regarding the bright side and dark side of IT. As discussed in Koppel (2008), Alter (2014), Röder et al., 2014), Andrade et al. (2015), Koppel et al. (2015) and in many other sources, there is often disagreement about whether workarounds generally belong on the bright side or on the dark side. For example, Alter (2014) summarizes how all of the following perspectives on workarounds can be found in the literature: workarounds as necessary activities in everyday life, workarounds as creative acts, workarounds as quick fixes that don't go away, workarounds as add-ons or shadow systems, workarounds as inefficiencies or hazards, workarounds as means for maintaining appearances, workarounds as resistance, and workarounds as distortions or subterfuge. In many of those cases, whether a workaround is seen on the bright side or on the dark side depends on the interests and concerns of the stakeholders.

Discussion and Conclusions

This conceptual contribution presented a new systems theory of IT innovation, adoption, and adaptation and explained how it provides a balanced perspective on the bright and dark sides of IT. This paper discussed the nature of systems theories, summarized WST, explained a new model of the stages of IT

innovation, presented a new systems theory, and explained how that theory illuminates the bright side and dark side of IT. A more thorough coverage would have explained the new systems theory in more detail and would have included a complete literature review instead of simply referencing relevant papers.

The ideas presented throughout this paper lead to three conclusions:

1) IT innovations in organizational settings can be viewed as changes in IT-enabled work systems.

2) Within work systems, IT may enable or empower, just as it may disable or threaten. In other words, inherent features or characteristics of IT in most business situations rarely imply that the use of IT will lead to either positive or negative impacts or outcomes.

3) The evaluation of whether a specific use of IT is beneficial or detrimental is subjective and depends on the observer's personal concerns and interests. As with the examples above, different observers may have different evaluations of whether the same IT enabled activities or outcomes are beneficial or harmful.

Overall, this paper provided a number of contributions but leaves much to be done.

Contributions

A new conceptualization. The first statement in the new systems theory says that IT innovation, adoption, and adaptation in organizational settings occur within work systems. The adoptive entity is not a hardware/ software configuration, but rather a new or improved work system that incorporates an IT innovation. This idea might lead to future reconceptualizations of IT innovation, adoption and adaptation.

A new systems theory of IT innovation, adoption, and adaptation. A key goal in creating the new theory was to provide a systems theory that could augment existing variance theories that dominate the innovation and adoption discourse in the IS discipline. The new theory was developed based on a general belief that a more holistic approach to IT innovation, adoption, and adaptation would be beneficial.

A new systems theory in the IS discipline. Demetis and Lee (2016) say explicitly that the IS discipline would benefit from greater use of systems theorizing rather than mostly positivist theorizing in the form of variance theories. This paper addresses their challenge directly by proposing a new systems theory. This new extension of WST joins other WST extensions that have many characteristics of systems theories. These include a work system metamodel, a set of work system axioms, a set of sociotechnical design principles, a theory of workarounds, and a theory of system interactions.

A stage model of IT-enabled work system innovation linked to a work system lifecycle model. The linkage between the stage model and the WSLC might lead to new ways of thinking about topics ranging from everyday IT innovation to "technochange" (Markus, 2004) that uses IT to drive organizational change.

A multifaceted view of the bright side and dark side of IT use. This paper applied various aspects of the new systems theory to understanding the bright and dark sides of IT. Some discussions of these topics focus on categories or variables correlated with either the bright side or the dark side. In contrast, this paper showed how a systems theory could be applied to identify a large number of topics and issues that are relevant to both sides. Use of a systems theory makes it easier to deal with the entanglement of interrelated topics such as why the IT came to exist in the first place, how the IT was adopted by this organization, how the operation of the work system evolved over time, possibly co-evolving with the IT, and how the IT-enabled work system operates in practice, including situations in which work system participants deviate intentionally or unintentionally from the system's design or from management intentions.

A balanced approach to the bright and dark sides. Neither WST nor the new systems theory assumes that outcomes will be positive or negative. Both assume that a wide range of outcomes are possible.

Next Steps

More complete links to the literature. By trying to cover so much territory, this paper did not have room for an extensive literature review. For a workshop paper, it seemed appropriate to focus more on

proposing new ideas and somewhat less on grounding the ideas in the literature. A complete journal article would call for a more substantial literature review.

Validation of the systems theory through case studies. The new systems theory was proposed by combining WST with a model identifying stages of IT innovation. That theory should be validated and likely improved through application to existing case studies or new case studies.

Applying a systems perspective to the bright side and dark side. This paper's attempt to apply a new systems theory to understanding the bright side and dark side of IT surely is not the only possible approach within a systems paradigm. A potentially valuable project could compare this paper's approach with other approaches to the same topic, including system-oriented, variance-oriented, and process-oriented approaches. That would be consistent with Demetis and Lee's (2016, p. 126)) argument that systems theorizing provides the IS discipline opportunities to "expand its ways of theorizing " ... [and to] offer better theories with which to interpret, explain, and even design information systems. It would also would be consistent with a suggestion from Burton-Jones et al. (2015, p. 676) that researchers should "treat theoretical perspectives more flexibly than they have in the past ... [and should follow] "a flexible and inclusive approach, guided by the dual principles of conceptual latitude and conceptual fit."

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