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Moving the Work System Theory Forward

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Abstract

Alter (2013) proposes the work system theory (WST) as the transformation of previously developed information system (IS) artifacts: the work system method (WSM), the work system framework, and the work system life cycle (WSLC). This transformation of IS artifacts into theory suggests a new set of questions regarding how we conceptualize theory and how it relates to the evaluation of IS artifacts. We conclude that such a transformation can benefit the information systems field if it enables the codification of generalized propositions that can be tested in realistic settings. Indeed, we suggest that this should be the ultimate goal of the construction of methodological IS artifacts such as those underlying the work system approach.

Keywords: *Work System Theory, Work System Approach, Theory Building, Theory Testing, Research Methods, IS Discipline.*

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1. Introduction

Academic research in the information systems field has long been interested in understanding and representing organizational systems, particularly those enabled by information and communication technologies (e.g., Davis and Olson (1985)). Earlier this year, *JAIS* published a paper detailing the work system theory (WST), which has been developed over the past two decades by Professor Steve Alter of the University of San Francisco. In this paper, Alter shifts the discussion from "an evolving systems analysis and design method for business professionals called the work system method (WSM)" to a proposal of theory that "provides a perspective for understanding systems in organizations" (Alter, 2013, p. 2). In proposing this transformation, several questions arise about creating such a transformation in general, and about this particular transition from design method to theory. Such a transformation raises questions about how to evaluate any conceptually interlinked pairing of "artifact"[1] and theoretical statements derived from it. It raises questions about differentiating the utility of the artifact in practice from the justification of generalized statements pertaining to the artifact and its position in practice (i.e., methodologies for evaluating the artifact itself may or may not be identical to those for justification of the theory). It also raises questions in particular about the WST and its role as part of the accumulation of knowledge about business process understanding, analysis, and design. In this dialogue paper, we address general questions about this type of theory development and the particular questions that pertain to WST. We conclude with "next steps"—suggestions for research activities that we see as necessary and sufficient for this type of innovative transformation.

Alter (2013) describes WST with respect to Gregor's (2006) categories of theories as "an integrated body of theory that includes a type I analytical theory (the work system framework) and a type 2 explanatory theory (the work system life cycle model), which, in combination, give the basis of a type 5 design theory (WSM)" (p. 95). Note that he does not propose this as either a type 3 (predictive) or type 4 (explanatory and predictive) theory. We view enhancing the body of knowledge regarding WSM so that it can additionally support claims across all theory categories as a worthy goal. We discuss the WSM in terms of its current state and what we envision as necessary steps toward such progression.

The work system framework uses four constructs to describe a work system: processes and activities, participants, information, and technologies. It uses five additional constructs to describe the work system's context: customers, products and services, environment, strategies, and infrastructure. The work system life cycle explains how work systems evolve over time through planned and unplanned modifications and adaptations. The work system method (WSM) is a "systems analysis and design method based on analyzing an 'as-is' work system and designing an improved version called the 'to-be' work system" (Alter, 2013, p. 12) using the work system framework and the work system life cycle.

Note that, throughout this paper, we distinguish between the work system[2] approach—the combination of the work system method (WSM) and work system (WS) framework from its cousin the WST as a theory per se. We can view the work system approach, in the terminology of Hevner, March, Park, and Ram (2004), as a set of IS artifacts (i.e., models (WS framework and WSLC) and tools (WSM)). As such, it should be evaluated based on its utility relative to its stated purpose, the development of high-quality work systems, of which high-quality information systems are frequently important components. On the other hand, the related WST, considered as a design theory, must be considered relative to the criteria pertaining to the justification of theory. It must, in the terminology of Gregor and Hevner (2013, p. A3), embody "prescriptive knowledge that describes the principles of form and function, methods and justification theory that are used to develop an artifact or accomplish

[1] We term the work system approach an "artifact" in the sense of being a set of human created intellectual tools or products intended to serve one or more purposes. Note that we see the entire set of frameworks, approaches, and tools as a collective "artifact" but acknowledge that each of the various elements or components might also be seen as an artifact in its own right. Acknowledging that there is potential for synergy in their interrelated use, we generally use the singular "artifact" in reference to the approach as a whole and "artifacts" as a compilation of components.

[2] We use the term "work system framework" to refer to the description and organization of the components used to represent a work system; the "work system method" as those processes and procedures by which the components of a work system are identified, analyzed, designed (re-designed), and implemented; the "work system approach" as the aggregation of framework and method; and the "work system theory" as the set of generalized statements and principles underlying the work system approach.

some end". The conceptualization of theory varies among scholars and we can not settle their differences in this discussion. However, the definition of "theory" can be quite broad and general or quite specific and narrow. We use Weber's (2012) recently published vision, definition, description, and criteria for assessing theory as a lens to present what we see as a range of issues and opportunities for our field in responding to Alter (2013). We choose this particular lens because we see it as representing the "traditional" view of theory widely held in the information systems field.

We do not begin this discussion as neutral observers. One of the authors has used the work system method (WSM) extensively to illustrate and provide a tool for understanding the union of technology, information, and business process in teaching both IS graduate students and MBA students. The WSM can be highly useful for this educational purpose. As a result, this discussion of WST is predisposed toward viewing the WSM as, at a minimum, pedagogically valuable. In this discussion, however, we focus on the potential value of using WST in practice. Demonstrating that WSM can be helpful in one circumstance does not address questions of whether it is generally helpful in other circumstances, whether there are precursors required for it to be helpful, how helpful it is, or whether it is more helpful than alternative approaches.

It is also important to acknowledge our predisposition toward the view that the development of (more) "indigenous" or native IS theory would be beneficial to the IS field (visit http://istheory.byu.edu/wiki/ for summaries of theories used in IS research, some of which are indigenous to IS but most of which are not). There is debate among scholars regarding both the degree to which the IS literature already comprises indigenous theory and the degree to which it ought to be so comprised. Whether one agrees or disagrees with Straub (2012) that there is already a significant percentage of "indigenous" theory in the IS literature, we see no reason that the field could not profit from more. Should WST become viewed as an important theory, it would be very much an indigenous IS theory (note that WST is included among the theories summarized at http://istheory.byu.edu/wiki/). WST clearly addresses a central theme of IS phenomenon as it is practiced in organizations. The integration of information, technology, and business process is fundamental to the planning, development, implementation, and use of organizational information systems (and, perhaps, might extend to hedonic or personal systems, too). By maintaining that these components are inextricably linked, this conceptualization addresses a key level of analysis that pertains simultaneously to both the mechanical workings of information technology and its larger context. Moreover, if this transformation from artifact to theory is successfully accomplished, it can offer a pathway for consideration of other opportunities for bridging design practice and theoretical generalization. At its best, such a process would help link somewhat disparate strands of IS research and provide some basis for integrating the IS researcher and practitioner communities.

In spite of our positive predisposition toward both WSM and the creation of indigenous IS theory in general, we consider it imperative to turn a critical and supportive eye toward the WST as currently formulated. We hope that a frank discussion will motivate and guide other researchers in interpreting and building on Alter's achievements for the overall benefit of the IS field. We assess the WST as it is currently formulated in terms of its scientific evolution—we do not consider it the responsibility of the investigator to bring forward a fully developed and justified theory, but rather to launch a stream of thought that with testing, modification, and extension can result in a widely recognized and used intellectual conceptualization. Toward this end, we have organized our comments into the sections that follow. In Section 2, we discuss conceptual issues regarding the results of attempting to transform the WS approach (visualized as a set of methodological IS artifacts—with the knowledge that this is not a bounded and concrete "thing" but rather a fluid set of principles and techniques subject to modification, growth, and selected application) into a theory. As such, we discuss what is meant by theory, and how the specification of the WST conforms or does not conform to the necessary criteria[3]. In Section 3, assuming reasonable agreement on conceptual issues, we discuss the opportunities that WST presents as a series of interrelated research questions and consider some

[3] The issue of whether or not a conceptualization such as the work system approach *needs* to be transformed to theory is an important one for the IS field but is beyond the scope of this paper. Whether or not it is necessary, we argue that successfully accomplishing this would be beneficial.

of the methodological and social context in which continued examination could occur. In Section 4,we conclude with some final thoughts about the role that this type of theory can play in our field.

2. Theory Development

2.1. Conceptualization

Alter (2013) has moved the accumulation of his thinking and experience with respect to work systems from a domain of pragmatic application (a framework, process, and, in our terms, an IS artifact) to an arena of generalization, abstraction, and justification. Alter (2013) devotes much space to explaining the frameworks and methods underlying the work system approach and how they can be applied in practice. He references numerous studies, primarily his own work or his work with collaborating authors (e.g., Truex, Alter, & Long, 2010; Truex, Lakew, Alter, & Sarkar, 2011), that describe these practices and provide anecdotal observations of their use. Over the years, Alter has proposed and refined a set of methods and tools for documenting and reflecting on integrated systems involving information, technology, and business process by using a research approach similar to the generate-and-test cycle described by Simon (1996) and prescribed by Hevner et al. (2004) for design science research. These conceptualizations aim to provide both language (constructs) and leverage (models and methods) for working with information systems that are embedded and fully integrated in an organizational context. These conceptualizations differ from traditional system development approaches such as ER diagrams and UML in that they focus on the interaction of organizational components (i.e., the nine components of the work system framework, including technology) rather than on the design of the technology itself. It is open to empirical testing whether this change in focus provides substantial advantages relative to other approaches that treat organizational and human considerations as simply part of "the environment" rather than as fully integrated components of the system itself.

2.2. Is the WST, as Formulated, Actually a Theory?

Alter (2013) asserts that WST is a theory and references Schatzki, (2001, pp. 12-13) in support of this assertion. He also references Gregor's taxonomy of theories in information systems research (Gregor, 2006). As mentioned in Section 1, there is no single universally held definition of "theory". In our view, the ultimate goal for a field is the accumulation of useful and replicable knowledge in its domain of interest—a cumulative tradition (Keen, 1980). This is generally formulated as a set of generalized statements that can be applied in particular cases. Thus, for example, a theoretical statement such as "use of a technology will increase with its ease of use" predicts that a particular information system that is easier to use will be used more than one that is more difficult to use. As such, when a theoretical statement holds true across a broader range of cases, research methods, and situations, our confidence in it can be expected to grow—the theory is "justified". Thus, the purpose of theory is to provide a mechanism for organizing generalizations that represent, at any given time, a best approximation of stable knowledge regarding a domain of phenomena. As a result of this viewpoint, we lean toward a broad definition of theory as "an ordered set of assertions about a generic behavior or structure assumed to hold throughout a significantly broad range of specific instances" (Sutherland, 1975, p. 9, quoted by Boxenbaum and Rouleau, 2011, p. 274). We observe that such assertions are theoretical generalizations even before they are tested. It is our confidence that grows or abates with additional tests, not whether or not the statement represents theory. We acknowledge, however, that others will hold the expectation that significant evidence must support such assertions before they are considered to be theory. It is not clear how much of an accumulation of evidence is needed to provide this sudden transformation to theory or what is gained by dismissing assertions before they have been tested. Nor is it agreed whether this is the responsibility of those proposing the theory or of the larger community building a field that provides understanding and utility to its stakeholders.

Alter (2013) states his intention to address Gregor (2006) theory types 1, 2, and 5. He addresses theory type 1 by presenting a taxonomy that enables analysis through identifying and naming essential features in a domain (work system framework). He addresses theory type 2 as he "expresses a dynamic view of how work systems change over time through iterations involving

planned change and emergent (unplanned) change" (p. 76). He also addresses theory type 5 by presenting a design theory that prescribes a sysetems analysis and design method for application to development activities (WSM).

We believe that Weber's (2012) view of theory presents a more difficult set of hurdles for a body of knowledge to be considered theory and is, therefore, a useful lens for examining WST. In our view, Weber (2012) presents a relatively standard and more restrictive view of theory in that he restricts the term "theory" to the type 4 in Gregor's (2006) taxonomy, which reflects both explanation and prediction. He explains that the elements of theory are (a) constructs measured as precisely as possible, (b) tested relationships among these constructs, and (c) a defined boundary in which these relationships apply. He states that theory must both predict and explain the phenomena under consideration, but he does hold that "models" may be valuable, even when they do not rise to the level of "theory". In applying Weber's criteria, we argue that it should be the goal of theory development to produce this type of theory. We attempt to develop a roadmap for moving the work system approach in this direction. We also acknowledge that a design theory (type 5) can pose generalized propositions that can be tested (Gregor & Jones, 2007); however, operationally, design knowledge tends to be more complex and interdependent, which results in difficulty in teasing out well-defined relationships and explicating *why* a particular design approach is effective or ineffective in a given context (Markus, Majchrzak, & Gasser, 2002; Niederman & March, 2012; Walls, Widmeyer, & El Sawy, 1992, 2004).

By Weber's (2012) definition, the WST would likely be viewed as an atheoretical model. The WST does not present clear, measurable, and indisputable constructs in the same sense as "the construct ease of use can be associated with the construct amount of use". It (implicitly) poses the proposition that "using the work system approach will result in high-quality work systems and enabling information systems". Note that Weber asserts that such models can be valuable, but, by definition, are not theory. We propose that the WST, even if viewed as "atheoretical" by this definition, is a potentially important contribution to the information systems literature and a possible precursor to the sort of theory that would satisfy a type 4 categorization. We see the WST as presenting the IS field with an opportunity to engage in a process of theory development and building, whether one takes the broader Sutherland (1975) definition or the more restrictive Weber (2012) definition. By invoking a process of testing, integrating, and evolving knowledge based on WST, there is potential value if such pursuits provoke research that results in generalizations that can both predict and explain the relationship between these particular artifacts and better work system and information system outcomes.

2.3. The Elusive Dependent Variable

Before addressing the WST in terms of each of Weber's criteria, we suggest there is one area of conceptualization of the current WST formulation that could be improved by additional specification. In our view, the concept of "purpose" is critical in generalizations pertaining to the science of the artificial (Simon, 1996). When people design, build, and deploy artifacts, these are generally to affect (for the better) some aspect of the environment. As Simon (1996) has suggested, everyone who designs is setting a course of action aimed at changing existing situations into preferred ones. We suggest that, as a theory WST should specify performance outcomes; that is, those characteristics we are looking to improve as a result of the course of action. As a theory, we should be able to test whether or not (and to what degree) the changes are predicted and/or explained by the theory. For a simple example, if we shorten the interval between iterations in an agile development method, we may intend to shorten the time for new products to come to market. We can compare average project duration before and after the new course of action to see if our prediction is supported by results. We can, perhaps, explain that shorter intervals between iterations leads to a tighter match between work activity and emergent project requirements. Thus, the result of applying the theory may be called "successful" or "supported" in a broad way when the application successfully instantiates the intended performance outcome.

We find that WST's purpose per se is not entirely clear in its current formulation. After many readings, we do not see clear and general statements about what WST is intended to accomplish. Alter (2013)

strongly implies that, by using the WS approach, some benefit will accrue to the user (organization). He states: "The work system framework is a useful basis for describing and analyzing an IT-reliant work system in an organization because its nine elements are part of a basic understanding of a work system" (p. 7). The assertion that the WS framework is "useful" adds an element of purpose, and thus falsifiability, to the WST. However, the terms "describing and analyzing" present a variety of possible interpretations. Is WST's purpose to present a tool aimed at clarifying business processes or, ultimately, to aid in building better systems? Implicit in the theory is explanation that one could build better work systems (or build them more cost effectively, or use them to create more positive value in the environment or to provide systems that are more readily accepted by stakeholders, etc.) because of the more thorough and diversified analysis induced by the use of the WS framework in whole or in part. In other words, are "thoroughness and diversification" the dependent variables of the theory, or are these moderating variables for an ultimate purpose of a different dependent variable: making better systems? We note this, fully aware of the separate but extremely thorny problem of actually assessing the impact of any tool on ultimate system development outcomes considering how many possible influences there might be and the challenges in sorting out the individual influence of any particular tool, especially when tools can be used with much variation in application (see, e.g., Watson, DeSanctis, & Poole, 1988; DeSanctis & Poole, 1994; Feldman & Pentland, 2003; Larsen, Niederman, Limayem, & Chan, 2009). Further, we recognize the difficulty of "field testing" a theory such as WST and its related conceptual artifacts (e.g., enrolling a number of different organizational entities that have a range of comparable system development projects to use multiple approaches, including WST, in order to compare their effectiveness). This, of course, is a difficulty not just for WST but for virtually all research aimed at evaluating IT artifacts and theories whose purpose is to impact practice[4].

In other words, we can envision a formulation of WST such as: those responsible for business process management will create better (less expensive, more reliable, more effective, etc.) systems using the WST in their system development practices than those not using WST. We think this is what the current formulation proposes, but, if we are wrong, it is at least partly due to this element of the theory not being clearly specified.

At this point, we turn to the more stringent view of theory that Weber (2012) proposes. In addition to defining theory, Weber (2012) sets forth five criteria for evaluating a proposed theory: importance, novelty, parsimony, level, and falsifiability. He uses these to analyze an exemplar paper published in *MIS Quarterly*, Griffith, Sawyer, and Neale (2003), that claims to advance theory. Weber points to places in this paper where additional rigor and definition might lead to stronger theory. In the same spirit, we use Weber's criteria to examine and structure a discussion of how the WST can be moved forward.

2.4. Is the WST Important?

From a research perspective, we see the WST as potentially important to the IS field in (1) presenting an approach that integrates system requirements definition with business purpose, (2) presenting a clearly indigenous IS theory based on observation and use in practice, and (3) providing a test case that shows how a "purely" pragmatic tool can be translated into a theoretical configuration that enables generalization and evaluation—in other words, if transforming the WST from "tool kit" to robust theory is successful, it provides a pathway for formalizing other development-oriented work, or, perhaps, an additional pathway.

From the perspective of IT practice, some evidence exists that using the work system approach can be beneficial. We do not yet know if this is a robust finding. We do not yet know if the WST outperforms alternative approaches (e.g., reengineering, technology focused design). On the other hand, in the realm of theory, the process of testing the WST holds the potential for elevating other processes toward being framed in theoretical terms (e.g., as generalizations that can be applied in future cases or further tested). Such testing may support the theory or suggest integration with other methods in larger and more nuanced generalizations; or may prompt through inability to support the theory in whole or in part, the emergence of more robust alternatives.

[4] As described below we see the stream of research in Group Decision Support Systems (DeSanctis, Poole, & Zigurs, 2008)) as an exemplar of the type of research required for this purpose.

Thus, we conclude that enough evidence has been collected to suggest that the WSM has the potential to be of significant value in practice and that the WST is worthy of testing and refinement. In our view, it has enough potential to merit that other scholars should continue investigating it and, perhaps, modifying it such that it can display its ultimate value. From a pragmatic perspective, as mentioned in Section 1, one of the authors has found the use of the work systems approach to be a valuable mechanism for teaching systems development concepts.

2.5. Is the WST Novel?

Novelty is a crucial part of any research contribution (Hevner et al., 2004). However, novelty can be interpreted in a number of ways. Consider, for example, the evolution of transaction cost theory as discussed by Tsang and Ellsaesser (2011). Coase's (1937) initial representations of a firm's purpose incorporated and refuted several earlier views. Forty years later, Williamson (1975) built on and extended Coases's initial representations. At both stages, the upgrading of theory was not in the "novelty" of the concepts but in the argumentation and extension of the argument's scope to a broader range of market structures. Should a clearly novel set of propositions emerge, it would almost guarantee theoretical value; however, not being novel per se may not be sufficient reason to dismiss "true" or "useful" knowledge when stronger arguments or reorganizations of elements improves an earlier formulation.

Clearly, the WS method and framework, having been developed over decades and being grounded in earlier work in socio-technical systems (Bostrom & Heinen, 1977a, 1977b), participative design (Markus & Mao, 2004), and soft systems thinking (Checkland, 1999), are not new ideas in and of themselves. The proposal for viewing the combination of the work system framework, the work system life cycle (WSLC), and the work system method (WSM) as a theory, however, is new and raises novel considerations about both the nature of theory and the relationship between design and generalization.

2.6. Is the WST Parsimonious?

Parsimony is an important part of any theory. Applying a quote attributed to Albert Einstein, theories should be "as simple as possible, but no simpler" (Garson, 2013). However, parsimony is a difficult criterion to judge. Parsimony does not mean "small" but rather "sufficient and without excess". The purpose of testing for parsimony is to identify extraneous parts of a theory: to make it less complex, more understandable, more applicable, and, therefore, more powerful. Work systems and the information systems integral to them are inherently complex (Brooks, 1987). Applying this criterion to the WST requires determining whether all elements of the theory as currently formulated are essential in *all* cases or in *some* cases, are optional (bringing benefits in some cases and not others), or are of high value in rare cases and little value in others. We see this situation as analogous to the value of a component such as screen clarity to a theory of communication: high resolution and detail may be critical in a telemedicine surgery context, but of moderate importance in periodic boardroom teleconferencing. In our view, it is only through on-going testing in organizational contexts that we would be able to learn whether or not the WST as currently formulated is parsimonious.

2.7. Is the WST at the Appropriate Theoretical Level?

We do not assume that one level of theory is better than another. Generalizations regarding broad topics may address a larger range of situations, but rarely will they fit as well to particular situations as mid-range or detail level theories. However, recognizing this criterion stimulates the question: what is the appropriate level to consider WST?

We would be hard pressed to consider the WST as a grand theory pertaining to the broad range of design phenomena and across all circumstances. We could envision testing of WST along with other formulations such as business process reengineering and technology-focused requirements determination methodologies as comprising a set of tools whose differentiated use across varied circumstances would describe something of a grand "planning design" theory. Perhaps it should be developed as part of a larger theory of organizational change.

However, we see the WST appropriately positioned as a mid-range or detail-level theory. As a mid-range theory: (1) it would need to be applied across many business process design situations, such as across functional areas or project goals (e.g. cutting costs, generating revenue, building platform for strategic positioning, affecting culture); and (2) the concept of technology would likely refer not only to information technologies but any kind of technologies that support business process (e.g., scientific development and production technologies).

As a detail level theory, WST provides scholars with relatively specific guidance for its application to fairly typical IS functional area projects. Approaches to such detail level theory testing can include: (1) examination and potential improvement of individual components, (2) the sequencing and intervals between application of components, and (3) the range of outcomes or dependent variables that may be affected by use of the WSM; their increased or decreased value individually, collectively, and differentiated by their importance to various stakeholders.

As currently presented, the intended theory level for WST is unclear. WST would be more viable as a theory if the level addressed were more clearly specified and explored. For example, perhaps WST may eventually be appropriately folded into a more general theory of business process reengineering or vice versa. However, we argue that the transition from design method to theory would be aided if a specific level is selected to focus the research efforts.

2.8. Is the Theory Falsifiable?

Falsifiability is commonly viewed as a key element of formal theory (Popper, 1963). If a statement cannot be demonstrated to be true or false, it is largely thought to be outside the realm of scientific theory. Of course, this makes sense when considering assertions pertaining to internal preferences, such as “James Bond films are better than Harry Potter films”. as opposed to assertions pertaining to objectively factual phenomena such as “James Bond films are more profitable than Harry Potter films”. This is at the crux of efforts to justify many of the indigenous IS theories, including WST—their assertions frequently pertain to internal preferences that are, as Searle (1995, 2010) describes, ontologically subjective but epistemologically objective. That is, their assertions pertain to value judgments such as “user satisfaction”, “perceived usefulness”, “quality of decisions”, or “implementation success”, which organizations have constructed (ontologically subjective) but are generally agreed on as shared beliefs in that social context (epistemologically objective) (see, e.g., the theories used in IS research wiki at http://istheory.byu.edu/wiki/).

We do not believe WST as currently posed is falsifiable. To be falsifiable, WST must include assertions that explain or predict outcomes that are epistemologically objective and operational measures of outcome performance. These are challenging tasks. Explaining why a work system was “successful” or “valuable” first requires criteria for measuring “success” or “value”, Such measures have been elusive (Larsen et. al., 2009). That does not mean, however, that pursuing such measures is not important. It is crucial. Furthermore, much valuable knowledge cannot be objectively falsified, including benchmarks and patterns. A benchmark is neither true nor false, but a target used to assess differences between intention and actuality. Some benchmarks may be more realistic, more helpful, or more carefully conceived than others, but they are neither true nor false. Similarly, frameworks and taxonomies are neither true nor false but are more or less useful. We can, however, ask questions that are falsifiable about the value, timing, and context of using such benchmarks, frameworks, and taxonomies in an epistemological sense. Patterns, templates, and abstractions such as the system development lifecycle can be very helpful as a skeleton from which individual cases may be built. They can be very helpful as a shortcut in development of new tangible or intangible artifacts. They may be valuable as a source of guidance, even if they are not “implemented” per se.

WSM consists of a set of models (WS framework and WSLC) and tools (WSM) for guiding systems analysis practice. These are neither true nor false, but more or less useful. Their evaluation in a design science sense, however, still requires operational measures of outcome performance from using them. Until such measures of outcome performance are developed and validated, it will be difficult to assess the value and contribution of the work system approach. Further WST, as a design

theory, must provide prescriptive knowledge for the accomplishment of the systems analysis task (Gregor & Hevner, 2013). As such, it must posit that using the work system approach leads to improved performance relative to other "best practice" approaches in a specified context (Gregor & Jones, 2007). This is falsifiable and, we believe, should be the basis for transforming the work system approach to the work system theory.

3. Next Steps

3.1. Framing the Next Questions

We see value in moving the work system research from a Gregor (2006) type 1 and 2 theory, highlighting systems analysis approach or set of IT artifacts describing a nascent type 5 theory (models and tools), to a Gregor type 3 and 4 theory based on a set of falsifiable statements. We see the pathway for such movement in various forms of "testing" in the sense of empirical and conceptual examination, confirmation, clarification, extension, refinement, and shrinking or compression of various elements. We see value in testing:

- The "artifact's" overall utility when holistically applied (does the use of this tool set collectively make a difference in development of new systems?).
- The WSM at the level of components including any prior states necessary for successful application, the execution of actions within each component, the contribution of each component toward the overall process, and the degree to which the overall process may suffer if a component is excluded.
- The sequencing of, and intervals between, application of the components.
- The "niave," prescriptive use of the components in a specified sequence, as compared to the "expert" use of the components as guidance, contingent upon the judgment of the designer.
- The motivations and triggers that prompt practitioners to use the WSM and, conversely, those that inhibit its diffusion, adoption and adaptation.

We see the testing of the WST as a whole to be analogous to the testing of group support systems (GSS) in the University of Arizona tradition (Nunamaker, Briggs, Mittleman, Vogel, & Balthazard, 1996). In early case studies (e.g., Grohowski, McGoff, Vogel, Martz, & Nunamaker, 1990; Martz, Vogel, & Nunamaker, 1992; Nunamaker, Vogel, Heminger, Martz, & Grohowski, 1989). The use of GSS was tested as part of an integrated program consisting of technology, facilitation, meeting facilities, selected group participants, and user-defined tasks. In general, these tests resulted in overall positive effects from GSS use. In this approach, the details of which technologies are chosen, how they are used, and the specific communication patterns of the group are allowed to vary organically. As variations emerge, the particularities of the case are recorded and reported but the results are manifested in overall use of the GSS program. In terms of WST, such testing, particularly by scholars at arm's-length, would add confidence to the initial findings if they are largely positive, provide clues to contingencies and boundaries if they are careful in showing where findings are and are not positive, and perhaps lead to reformulation or continued refinement if largely negative. It is possible that the expertise of the researchers who created the work system approach provided a key element in implementing it in practice. For example, it may be their enthusiasm and commitment to the process in addition to or instead of the particular steps that is crucial for generating positive outcomes. Alternatively, as creators of the process, they may feel license to modify it to particular circumstances that users following a prescription might not equally experience. This itself might be a worthy finding (and perhaps lead to some program for "forcing" potential designers to reinvent their own version of whatever might resemble the work system approach).

We see testing of the WS approach's components to be somewhat analogous to the testing of group support systems in the Minnesota tradition. In many of the GSS experiments (e.g., Zigurs, Poole, & DeSanctis, 1988; Sambamurthy & Poole, 1992; Niederman & Bryson, 1998; DeSanctis et al., 2008), the emphasis was on issues such as the technology's levels of restrictiveness or the use of different kinds of facilitation. In this sense, the concept was to get "inside the black box" and look at how the system's configuration affects outcomes. This approach assumes that the details of how the socio-technical system (including both the science of IS components and the art of facilitation) is configured must be known to determine when and how to achieve positive results in the use of the technology (conceptual and concrete IT artifacts). In terms of the WST, it may be that some configurations of use of the system create more benefit than others (universally or contingently). The discovery of these could explain mixed findings in application of the system holistically. It could push the system from one of possible to frequent or even deterministic benefit.

We envision the potential for users of the WS approach to move through its various components and activities in multiple ways (e.g., focusing on customers before or after focusing on products and services or focusing on strategies before or after focusing on the work system itself). We would see each variation in the sequence of movements through the components as a pathway and repeated use of particular pathways as suggestive of patterns. Examination of the frequency and resulting outcomes of the use of the WS approach following these different pathways or patterns would call forth formulation of theoretical generalizations following the broad framework of process theory. In terms of the WST, it may be that some components must precede or follow others, that some sequences are followed more frequently by naïve (or unguided) users, and/or that such patterns of progression through the steps correlate with more or less success. Given the WS framework's nine components, we can see the potential for numerous ways to implement each component and we can see the potential for the choice of pathway (or the rigorousness in following a pathway) to affect the outcome.

At this time, to the best of our knowledge, the WS approach has not yet been broadly diffused throughout practice. It has been perhaps modestly distributed in educational and research settings. Given the newness of this artifact and its potential to spread, one might approach this using various models (e.g., Swanson and Ramiller's organizing vision concepts) (Ramiller & Swanson, 2003; Swanson & Ramiller, 1997), Rogers' (1976) diffusion model, Gartner's (2012) "hype cycle" (Gartner, 2012)) and examine the predictions each would make. The WST could be updated based on actual findings and perhaps the extant models would be updated based on these findings. We expect that, at this time, the artifacts comprising the WST are not yet widely enough spread or thoroughly enough used to make survey sampling of users and potential users likely to yield great value; however, we would be pleasantly surprised to be wrong about this.

3.2. The Pursuit of Evidence, Support, and Confidence

Alter's testing so far has focused on establishing that the WS approach can indeed produce positive results under some circumstances. Alter (2013) asserts that a variety of studies using the work system approach show that it can provide benefits to the organizations that use it. However, much work remains to be done to show that the WS approach more generally provides benefits to those who use it, that it provides more benefit than alternative approaches (such as focusing primarily on technology or business issues rather than the integrated system), and across what circumstances such benefits can be realized. To date, though, most of this evidence has been collected by Alter himself and in collaboration with colleagues such as Truex (Truex et al., 2010; Truex et al., 2011). This only stands to reason. Until a theory has become established no one else knows about it and, therefore, it isn't likely to be tested by anyone else. However, we would see passing tests created by others, at arm's-length to be a critical threshold for accelerating confidence in the theory. On the other hand, there are significant practical obstacles to such testing. We know of no top IS journal that regularly publishes "replication studies", which implies that papers supporting the predicted results could be rejected because they "show nothing new". In practice, the testing of such a theory (and publication of the results of these tests) may either require some sort of semi-fictional additions, such as we see with minor extensions in a nomological net, or it may require a mass of publication outside of "top" journals in order to become established through that channel. One way or another, despite

what we see as a problematic dilemma, for the importance of the WST to be established, it will have to survive tests (or evolve relative to varied findings) conducted by scholars at arm's-length. The situation is not hopeless, of course. We note that, in the management literature, theory pertaining to goal setting has taken root in spite of the fact that the bulk of work over the past three decades has been atheoretical and empirical and has represented many small variations on the central theme and varied methods in laboratory and in the field (see, e.g., Latham, 2004; Locke & Latham, 2002).

At this point, we do not yet have evidence of whether the WS approach outperforms other tools and methods that aim to aid in planning and executing the development of new systems. The WS approach addresses the transformation of systems where those systems integrate information, technology, and business process. One can view this approach as competing with alternative restructuring or reengineering approaches. The literature on business system reengineering suggests that there are many such approaches. It is not established (though there is a certain logic to it) that viewing systems as the integration of information technology and business process will provide more value than alternatives more specifically targeted to hardware and software design in the context of organizational purposes. Several papers focus on "business systems", which we see as closely related to if not synonymous with "work systems" (e.g., Kettinger, Teng, and Guha, (1997), Guha, Kettinger, Teng, (1993), Rao, Gunhan-Mansingh, and Osei-Bryson, (2012), and Damjanovic, (2010)).

4. Conclusion

We argue that the transition from the development of an artifact to the presentation of key aspects of the artifact in the form of a theory presents the IS field with a set of valuable opportunities. However, there remains the question of whether the costs and risks of undertaking the venture of testing, nurturing, applying, and modifying the initial version of the theory until it is robust is a worthy investment. Time and energy are limited and decisions of which research topics to pursue can have serious impact on the careers of individuals and collectively on the ability of the field to present itself as important, effective, and worthy of attention. It is our view that aggressive pursuit of theory adds value to a field. Much of this value, however, is captured in the development and evaluation of the artifact per se. The extra step of transformation into theoretical statements provides a proven framework for accumulating rigorously formulated knowledge propositions, which enable that value to be codified.

The artifact's and the theory's success are not independent. To the extent that the theory consists of statements about the success of the artifact, of its components, and of the ability to integrate its use in specific environments, the artifact's quality is central to and perhaps a basis for the power of the theory. Statements about the artifact in theoretical format provide a pathway to formalizing its testing, to broadening the range of investigators who have access to using the artifact and reporting their results, and to capturing in methodical form the collection of those results. In this sense, the transformation of an artifact into a theory may be viewed as a logical extension of design theory, which prescribes both the development and evaluation of artifacts.

Time will tell whether the artifact(s) underlying WST have the robustness to make a difference in practice and whether other researchers will use the theory in meaningful ways. We envision the results of such testing to fall into three broad categories: those showing successful, those showing partially successful, and those showing unsuccessful application of the work system theory.

If efforts toward using and enhancing the WST are successful, the field can boast about a robust theory. This provides the power that comes with applying generalized statements to particular cases with confidence that they will hold true in the particulars. In turn, this allows for the direct application of solutions without the necessity to reinvent them each time (while acknowledging some variation in results due to variations in the specifics of particular cases). Offering tested reliable artifacts for analyzing business process that fully integrate information, technology, and activities can have significant impact on the cost and effectiveness of individual development projects. Given the number of such projects and the resources invested in them, WST's potential value is dramatic.

If such efforts are partly successful, we might have a semi-robust theory that provides guidance in "best case" or normal circumstances, that provides a framework of contingencies regarding its use (hypothetically this might consist of boundary defining statements such as "for very small projects, modules 2, 4, 7 in that order should suffice" or "for very large projects all modules with particularly large time in module 4"). We might also see that a moderating variable, such as senior management support or incentive structures, might mean that when such a factor is present the WST offers a high probability of success, whereas the probability of success is lower when it is absent.

It is also possible that no WST studies would provide supportive results. This may indicate that the development environment is too complex for one particular approach to dominate, that the method works only under narrowly favorable circumstances, or that other approaches are indeed better. It might also show that design is more of an art, dependent on the expertise and creativity of individuals, rather than a science where following any particular prescription guarantees or even correlates with success.

We would argue that there is positive value for the field in the knowledge that would be created given each of these three broadly conceived outcomes. Clearly, where application of the artifact proves to be robust and successful, the creation of a stable theory will profit the IS field clearly and visibly. Should the artifact prove trickier to implement or more varied in its impact, this information can also be useful in redirecting energy to other targets.

Individual researchers face many options about how to spend their time and energy in planning studies aimed at impacting the research community and our broader society. We envision the IS field as diverse where many valid, important, and potentially profitable directions are and should be available to researchers (March & Niederman, 2012). While the field as a whole may profit from any level of successful testing of the WST, individual researchers are the ones who face the risks when selecting research topics. We see such risks as including:

1) Finding business sites that are interested in participating in research and allowing the publication of results. We find that some individual researchers are more endowed with talent in this area than others. The search for such organizations and the ability to work with them can absorb a good deal of researcher energy

2) Having enough knowledge and skill to apply the work system in organizational settings (or devise realistic simulation and experimental conditions) for adequate testing, and

3) The existence of venues interested in or willing to publish work based in this area—field studies are often more difficult to interpret and explain, replications are generally shunned, and results that support prior findings are often viewed as "not novel" enough.

On the other hand, from our teaching experience, there is an intuitive understanding of the work system among IS students, particularly the more mature ones who have struggled with introducing systems into organizations and the functional area students (e.g., accountants and marketers) who find it difficult to integrate their business needs into developing technology. For clever researchers, opportunities abound to integrate teaching with student activities. Skillfully shaping projects that instruct students, provide value to local organizations, and are structured to produce meaningful (and hopefully publishable) findings may not be simple, but offers an approach to continually examine and evaluate the work system approach.

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