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Steven Alter
University of San Francisco, alter@usfca.edu

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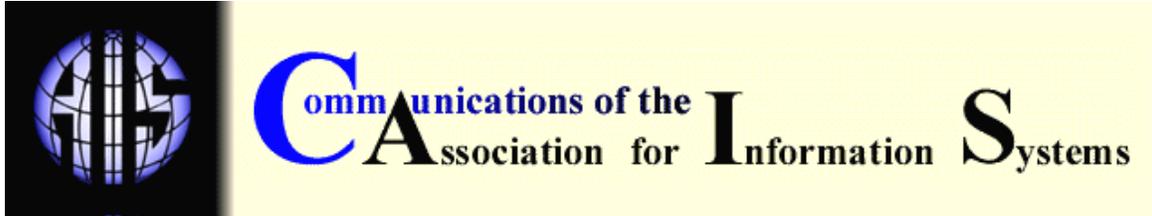
WORK SYSTEMS AND IT ARTIFACTS – DOES THE DEFINITION MATTER?

Steven Alter
University of San Francisco
alter@usfca.edu

ABSTRACT

Lurking just under the surface of longstanding debates about rigor versus relevance and about the core and scope of the IS field is the question of whether inadequate definitions of basic terms is an obstacle to progress. This article focuses on whether the definition of IT artifact or work system really matters. It identifies five definitions of IT artifact and IT-enabled work system, and then looks in detail at whether the definition of work system mattered in Jasperson, Carter, and Zmud's [2005] article in *MIS Quarterly* about post-adoptive behaviors. It argues that their definition perhaps affected their conceptualization of post-adoptive behaviors. It presents an alternative model illustrating how a different definition and greater attention to work system issues might have led to a different conceptualization that addresses different issues.

Keywords: work system, IT artifact, post-adoptive behavior

I. INTRODUCTION

This article looks at an issue that lurks under the surface of longstanding debates about rigor versus relevance and about the core and scope of the IS field. In my opinion, the IS field often uses inadequate definitions of its basic terms. For example, in the last several decades terms such as IS, ISD, DSS, expert system, knowledge management, and CRM, took on many meanings, resulting in three problems:

- Previously published generalizations or research findings about IS, ISD, DSS, CRM, and other important topics cannot be quoted meaningfully without explaining how the author of the generalization defined the term, if it was defined at all.

- It is hard to accumulate knowledge because conclusions about IS, ISD, DSS, CRM, and other important topics may use those terms in different ways.

- Articles about topics such as IS, ISD, DSS, and CRM sometimes cite examples that exhibit only a subset of the purported characteristics of the category, and may not even conform to the article's own definition of those terms. In biology, for example, all examples of cats would be expected to have the characteristics of cats, and borderline cases would be identified as such. The IS field seems less concerned about such distinctions.

This article explores basic terminology related to the core and scope of the IS field. The longstanding debate about the core and scope was re-energized by Orlikowski and Iacono's [2001] article "Desperately Seeking the IT Artifact in IS Research," which identified five different

interpretations of the IT artifact in articles published in *Information Systems Research* during 1991-2000. Two years later, Benbasat and Zmud [2003] suggested that the IT artifact and its immediate nomological network are the core. Their article spawned a large number of responses in *CAIS* and *JAIS*, some of which were referred to by Agarwal and Lucas [2005] in yet another response to the original article.

The term IT artifact is problematic for a variety of reasons. After proposing "18 Reasons Why IT-Reliant Work Systems Should Replace 'The IT Artifact' as the Core Subject Matter of the IS Field," [Alter, 2003a], I was pleased to see the term work system in the title of the 2005 *MIS Quarterly* article by Jasperson, Carter, and Zmud [2005] called "A Comprehensive Conceptualization of Post-Adoptive Behaviors Associated with Information Technology Enabled Work Systems." The appearance of that article provided an opportunity to ask again whether any important differences exist between an IT artifact and an IT-enabled work system. Does the definition of these terms actually matter? Given that the definition of IT-enabled work system in Jasperson, Carter, and Zmud [2005] seems to be an extension of the definition of IT artifact in Benbasat and Zmud [2003], this article focuses on the two definitions of IT-enabled (IT-reliant) work system in Table 1. For the sake of conciseness this article calls one of these the WSF definition because it is based on the work system framework [Alter, 2003a] and calls the other the JCZ definition based on the names of the authors. After comparing the definitions in detail, this article argues that the JCZ definition perhaps affected their conceptualization of post-adoptive behaviors (Section II.) An alternative model (Section III) illustrates how a different definition and greater attention to work system issues might lead to a different conceptualization that addresses different issues.

II. DEFINITIONS OF IT ARTIFACT AND WORK SYSTEM

Table 1 presents definitions of IT artifact and IT-enabled or IT-reliant work system that appeared in five articles in 2001, 2003, and 2005. In response to Orlikowski and Iacono's [2001] focus on IT artifacts, Alter [2003a] proposed replacing the IT artifact with IT-reliant work systems. Shortly thereafter, Alter [2003b] identified a number of difficulties with the term IT artifact as defined and used by Benbasat and Zmud [2003]. More recently, Jasperson, Carter, and Zmud apparently replaced the term IT artifact by the term work system, but seemed to retain the core of the definition in Benbasat and Zmud [2003].

Table 1. Definitions of IT Artifact and Work System

Term	Definition
IT artifact: [Orlikowski and Iacono 2001]	"By and large, IT artifacts (those bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software) continue to be under theorized." (p. 121) Five premises for theorizing about IT artifacts (p. 131) include: 1. "IT artifacts, by definition, are not natural, neutral, universal, or given." 2."IT artifacts are always embedded in some time, place, discourse, and community." 3. "IT artifacts are usually made up of a multiplicity of often fragile and complementary components, whose interconnection are often partial and provisional and which require bridging, integration, and articulation in order for them to work together." 4. "IT artifacts are neither fixed nor independent, but they emerge from ongoing social and economic practices." 5. "IT artifacts are not static or unchanging, but dynamic."
IT artifact: [Benbasat and Zmud	"We conceptualize the IT artifact as the application of IT to enable or support some task(s) embedded within a structure(s) that itself is embedded within a context(s)." (p. 186). The four

2003]	elements of an IT artifact include information technology, task, task structure, and task context (Figure 1, p. 188)
IT artifact: [Agarwal and Lucas 2005]	"We also recommend expanding the definition of the IT artifact from "enabling or supporting some tasks" to specify IT as the integration of the processing logic found in computers with the massive stores of databases and the connectivity of communications networks. The IT artifact includes IT infrastructure, innovations with technology, and especially the Internet." (p. 394)
Work system: [Alter 2003a]	"A work system is a system in which human participants and/or machines perform work using information, technology, and other resources to produce products and/or services for internal or external customers." (p. 368) The nine elements of the work system framework (see text below) provide a starting point for understanding or analyzing a work system. Work practices, participants, information, and technology are considered to be within the system. Other elements that are part of even a rudimentary understanding of a work system include the products and services it produces, the customers, the environment, the external infrastructure that it uses, and the strategies within which it operates.
Work system [Jasperson, Carter, and Zmud 2005]	"The work system represents the context within which organizational members perform their assigned work. Thus, the work system includes organizational members, the work tasks undertaken by members, work processes, technology features that enable or support work tasks and processes, and social structures that direct organizational members both in their work-related behaviors and in their interactions with each other. Social structures include both performance-related (e.g., performance evaluation and feedback, promotion, merit pay, bonuses, etc.) and personal-related (e.g., social recognition, reputation, social interaction, etc.) incentives and disincentives that prior research suggests are likely to influence individual behaviors, including IT use. An organization's members are obviously core elements of the work system, both in performing work-related roles and as users of work-enabling technologies. Most important, given that an organization's members continuously interpret their work context their work system sensemaking becomes an especially critical subcomponent of the work system." (p. 535)

Instead of rehashing discussions of previous comments about IT artifacts, this article focuses on the term work system, which I personally believe is both clearer and more useful than the term IT artifact when referring to IT-enabled systems in organizations. Regardless of the definition chosen, I believe work system is preferable to IT artifact because work system brings immediate associations with people doing work at least somewhat systematically, whereas IT artifact brings many associations related to technology per se. The term work system was used occasionally in a number of articles over the last thirty years[1], including two articles by Bostrom and Heinen

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[1] The term *work system* appeared in two articles in Volume 1 of *MIS Quarterly* [Bostrom and Heinen, 1979a, 1979b]. Mumford and Weir [1979, p. 3] spoke of "the design and implementation of a new work system." Davis and Taylor [1979, p. xv] discuss "attempts at comprehensive work systems design, including the social systems within which the work systems are embedded." Trist [1981] said that "primary work systems are the systems which carry out the set of activities involved in an identifiable and bounded subsystem of a whole organization - such as a line department or service unit." [p. 11] and "The primary work system ...may include more than one face-to-face group along with others in matrix and network clusters." [p. 35] More recently, Mumford [2000] summarized sociotechnical insights cited by Pasmore [1985], such as "The work

[1979a; 1979b] in the first volume of *MIS Quarterly*, but I do not believe the term was defined clearly and treated as an analytical concept until the third edition of an IS textbook [Alter, 1999b] and a *CAIS* article called "A General, but Useful Theory of Information Systems." [Alter, 1999a]

COMPARISON OF TWO DEFINITIONS OF WORK SYSTEM

The idea of work system is consistent with Orlikowski and Iacono's [2001] five premises related to IT artifacts (Table 1). Work systems "are not natural, neutral, universal, or given." They "are always embedded in some time, place, discourse, and community." They consist of multiple, fragile, complementary components. They are "neither fixed nor independent, but they emerge from ongoing social and economic practices." They "are not static or unchanging, but dynamic."

The work system framework (Alter [2003a], p. 369) provides an essentially static view of a work system, answering the question "What work system are we analyzing here?" The nine elements in the work system framework provide an outline for understanding or analyzing a work system. The four elements that summarize the system itself include work practices, participants, information, and technologies. The five other elements that are part of even a basic understanding of a work system include products and services produced, customers, environment, infrastructure, and strategies. These nine elements also provide an outline for drilling down into important issues [Alter, 2005]. For example, work practices can be understood and analyzed using a number of different lenses such as business process (work flow), decision making, communication, coordination, control, information processing, and sensemaking. Similarly, participants can be understood by looking at individuals, groups, roles, impacts on participants, and impacts of participants. Each of these lenses contains different types of properties including components and phenomena, actions and functions, characteristics, performance indicators, and relationships.

Complementing the static view in the work system framework, the work system life cycle (WSLC) model ([Alter 2003a], p. 370) provides a dynamic view by summarizing how work systems change over time. Unlike the system development life cycle, which is basically a project model, the WSLC is iterative. It represents a work system's life cycle as a series of iterations in which semi-stable operation and maintenance phases are the starting point for new cycles of initiation, development, and implementation phases when management decides to launch a formal improvement project. The WSLC includes both planned and unplanned change. Planned change involves formal projects that proceed through initiation, development, and implementation phases. Unplanned change via unanticipated adaptations and experimentation may occur during the operation and maintenance phase or during project phases when unexpected issues and new understandings emerge.

The goal of Jasperson, Carter, and Zmud [2005] was to conceptualize post-adoptive behaviors, rather than to theorize about work systems. Their extensive literature search and related conclusions provide a number of useful ideas that should be incorporated into a more detailed version of the WSLC.

The JCZ definition of work system seems to be an extension of the Benbasat and Zmud definition of IT artifact in Table 1. The tangential nature of the term work system in the JCZ article is clear

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system should be seen as a set of activities contributing to an integrated whole and not as a set of individual jobs" and "The work system should be regulated by its members, not by external supervisors." Land [2000] said "socio-technical methods focus on design of work systems to improve the welfare of employees. The prime aim of redesigning work systems is the improvement of the quality of working life." Other IS researchers such as Sumner and Ryan [1994] and Mitchell and Zmud [1999] also used the term. In addition, the term *high performance work system* appeared occasionally in the popular business press and in some consulting circles to describe organizations with high degrees of participation and self-management.

because it is not defined until the 11th page, after the term work system is used eleven times previously. As a replacement for the term IT artifact, work system surely provides a more convenient and understandable frame of reference for post-adoptive behaviors. For instance, saying that post-adoption behaviors occurred within a work system sounds more natural than saying post-adoption behaviors occurred within an IT artifact.

Given the secondary role of the term work system in the JCZ article, I believe it is unfair to expect that its ideas about work systems would be as specific or elaborate as a work system conceptualization that was developed over a number of years. Nonetheless, I think it is useful to consider the differences in the definitions, especially in light of past concerns about the term IT artifact. More important, implications of alternative definitions may be useful to researchers who are framing empirical research or theorizing within a work system approach.

Comparison of JCZ and WSF

This section compares the work system framework (WSF) and the definition used by Jasperson, Carter, and Zmud (JCF) in terms of the WSF elements.

Work practices include all of the activities within the work system. These activities may combine information processing, communication, decision making, coordination, sensemaking, thinking, and physical actions. Work practices replaced business process in the core of the work system framework in 2003 for two reasons:

1. because important activities in many work systems are so unstructured that the term business process is inappropriate, and

2. because business process is but one of the important lenses for understanding activities within a work system.

- The JCZ definition of work system includes "work tasks undertaken by members" and "work processes."   Although the JCZ definition does not contain a second layer, there is no reason to doubt that the work tasks and work processes it refers to could combine information processing, communication, decision making, coordination, thinking, and physical actions. The paragraph introducing the definition refers to sensemaking explicitly, saying, "given that an organization's members continuously interpret their work context, their work system sensemaking becomes an especially critical subcomponent of the work system."

Participants are people who perform the work within the work system. Some participants may use computers and IT extensively, whereas others may use little or no technology. When analyzing a work system, the more encompassing role of work system participant is more important than the more limited role of technology user (e.g., Lamb and Kling [2003]) whether or not particular participants happen to be technology users.

- The JCZ definition of work system says, "an organization's members are obviously core elements of the work system, both in performing work-related roles and as users of work-enabling technologies" (p. 535). Explicit inclusion of people in the work system is an important distinction, especially after past confusions about the definition of IT artifacts (e.g., the five views of IT artifacts in *ISR*, as reported by Orlkowski and Iacono [2001]). Use of the term organization members instead of work system participants seems to imply that external contractors or members of other organizations are excluded. In contrast, WSF uses the term participant because work systems such as supply chains or large projects can operate within or across organizations.

- The JCZ definition also refers to "social structures that direct organizational members both in their work-related behaviors and in their interactions with each other. Social structures include both performance-related (e.g., performance evaluation and feedback, promotion, merit pay, bonuses, etc.) and personal-related (e.g., social recognition, reputation, social

interaction, etc.) incentives and disincentives that prior research suggests are likely to influence individual behaviors, including IT use." (p. 535). The WSF definition does not refer to social structures explicitly, but its second level includes individuals, groups, roles, impacts on individuals, and impacts of individuals. "Incentives and disincentives" are a central aspect of impacts of individuals. These impacts are driven by responses to incentives, but also involve other factors that are not referred to directly in the JCZ definition, such as knowledge, skills, attitudes, and interests. In most cases, WSF would view social structures such as promotion, merit pay, and bonuses as part of the environment within which a work system operates. Depending on the purpose of a particular analysis, it would treat performance evaluation either as part of the work practices within a work system or as a separate work system.

Information includes codified and non-codified information used and created as participants perform their work. Typical codified information is the pre-defined information used in tracking packages, entering orders, and performing repetitive financial transactions. In each case, each data item must be defined precisely, and the information is usually processed using explicit rules. Typical uncodified information includes computerized or handwritten documents, verbal agreements, and formal or informal conversations. Information may or may not be computerized. Information not related to the work system is not directly relevant, making the common distinction between data and information secondary when describing or analyzing a work system. Knowledge can be viewed as a special case of information. Explicit knowledge is recorded in documents, images, rules, and other forms. Tacit knowledge exists in people's heads and is not explicit.

- The JCZ definition of work system includes neither data nor information nor knowledge. This omission is surprising because work systems cannot operate without information, and because post-adoptive behaviors for many types of information technology are related to the availability and quality of the information that might be processed or is being processed currently.

Technologies are tools that help people work more efficiently. Technologies tailored to specific business situations usually involve a combination of general-purpose tools and specialized techniques, such as mortgage calculation formulas. Separation between tools and techniques is worth considering because it is often possible to improve the tool (e.g., moving to a better laptop) without changing the technique. Similarly, it is possible to change the technique (e.g., moving to a better mortgage calculation method) while using the same laptop.

- Instead of technology per se, the JCZ definition of work system considers "technology features that enable or support work tasks and processes." The term features is fundamental to JCZ's discussion of post-adoptive behaviors and appears 86 times in the article (based on a count by Adobe Acrobat). It seems likely that technology, rather than technology features, would be the natural term to include in a general definition of work system.

Products & services are the combination of physical things, information, and services that the work system produces for its various customers. A work system's products and services may take various forms, including physical products, information products, services, intangibles such as enjoyment and peace of mind, and social products such as arrangements, agreements, and organizations. As mentioned earlier, products and services are not part of the work system, but should be considered when attempting to understand or analyze a work system.

- The JCZ definition of work system does not consider the products and services produced by the work system.

Customers are the people who receive, use, or benefit directly from products and services that a work system produces. In most cases they can experience or perceive at least some aspects of the quality of those products and services. Customers may include external customers and

internal customers. As with products and services, customers are not part of a work system but should be considered when attempting to understand or analyze a work system.

- The JCZ definition of work system does not refer to the work system's customers.

Environment includes the organizational, cultural, competitive, technical, and regulatory environment within which the work system operates. Factors in the environment affect system performance even though the system does not rely on them directly in order to operate. The organization's general norms of behavior are part of the culture in the environment that surrounds the work system, whereas specific behavioral norms and expectations about specific activities within the work system are considered part of its work practices.

- The JCZ definition of work system starts by saying, "the work system represents the context within which organizational members perform their assigned work." The definition also considers "the social structures that direct organizational members both in their work-related behaviors and in their interactions with each other." Those social structures include "performance-related" and "personal-related" incentives and disincentives.

- It is unclear whether environment in WSF and context in JCZ have the same meaning. In WSF the environment surrounds the work system and is important to consider because it affects the work system's performance even though it is not part of the work system. By saying that "the work system represents the context within which organizational members perform their assigned work," JCZ is unclear about whether a work system is distinct from its own context, and whether a separate environment that surrounds the work system should be included in an understanding of a work system.

Infrastructure includes human, informational, and technical resources that the work system relies on even though these resources are managed outside of it and are shared with other work systems.

- The JCZ definition of work system considers technology features that are perceived by organizational members, but does not mention technical infrastructure that may be invisible to technology users. Neither does it refer to human or informational infrastructure that may be shared with other work systems.

Strategies consist of the guiding rationale and high-level choices within which a work system, organization, or firm is designed and operates. Strategies at the department and enterprise level may help in explaining why the work system operates as it does and whether it is operating properly. Although sometimes not articulated clearly, high-level choices about a system can often be inferred by considering plausible alternatives that were not chosen.

- The JCZ definition of work system does not refer to strategies.

DOES THE DEFINITION MATTER?

The WSF and JCZ definitions of work systems differ on a number of details, but it may not be apparent whether the differences matter much. I believe the differences don't matter much if work system is used as a throwaway term mentioned in passing as a synonym for organizational context, business process, or system in an organization. On the other hand, I believe the differences matter a great deal if work system is used as a unit of analysis for understanding or analyzing a system in an organization.

As a specific example of the importance of the definition, consider whether the JCZ definition truly supported the attempt to conceptualize post-adoptive behaviors. The article raised many valuable points that have not been explored or consolidated as thoroughly in the past, but I think it might have been even better if the article's definition of work system was clearer and more complete.

Effect of Omissions from the Definition

The JCZ definition of work system (Table 1) includes organizational members, work tasks, work processes, technology features, and social structures, but does not mention information, one of the four central elements in the WSF definition. Given that JCZ's purpose is to explore post-adoptive behaviors, it is worth asking whether information might raise important issues in post-adoption decisions about the use of particular technology features. JCZ's conceptual model of post-adoptive behavior ([Jasperson, et al., 2005] Figure 2 on p. 534, shown as Figure 1) includes an individual cognition submodel and an organizational action submodel. Elements of the individual cognition submodel include individual attention, individual cognitions, individual differences, post-adoptive intentions, technology sensemaking, and other factors. Separate from the claimed benefits of technology features that assume information is not problematic, it seems likely that accuracy, timeliness, completeness, accessibility, and security of information are also important determinants of post-adoptive behavior. For example, when considering unused features of a report generator, graphics tool, or model, lack of high quality information should quickly overwhelm positive beliefs or intentions related to unused technology features.
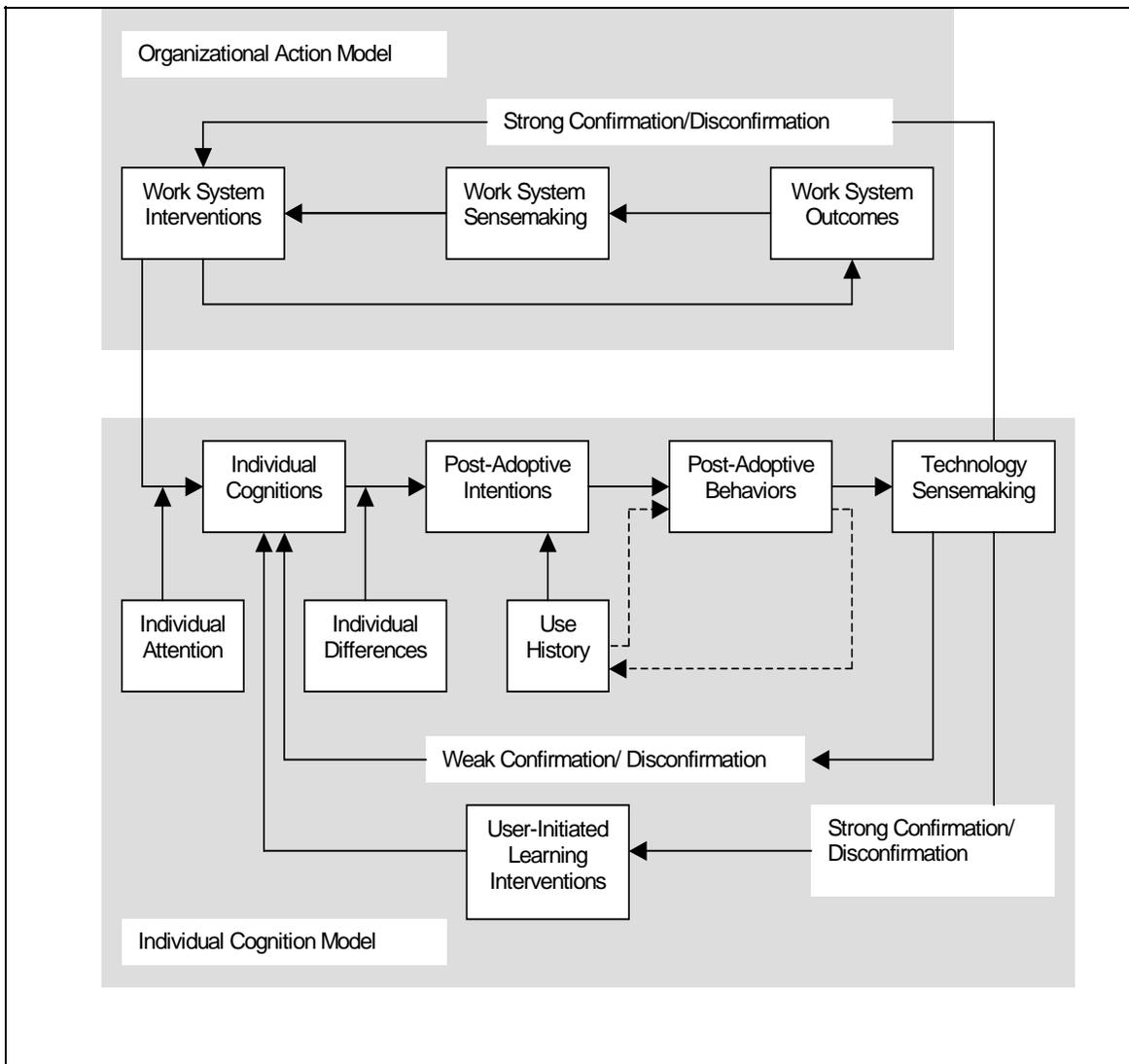
Source: Jasperson et al [2005, p. 534]. Copyright © 2005 by the Regents of the University of Minnesota. Used with permission.

Figure 1. Conceptual Model of Post-Adoptive Behavior.

To a lesser extent, the JCZ definition's omission of products and services, customers, and environment limit the conceptual model in Figure 1. For example, customer issues and issues in the surrounding organizational and competitive environment may generate important reasons for using previously unused technology features.

Effect of Clarity of the Definition

In addition to the JCZ definition omitting information and several other topics that are frequently relevant to understanding a system's operation and performance, the JCZ article contains four statements whose use of the term work system seems inconsistent with the JCZ definition of work system.

- "We argue that organizations need aggressive tactics to encourage users to expand their use of installed IT-enabled work systems." (p. 525)

- "In general organizations may be able to achieve considerable economic benefits (via relatively low incremental investment) by successfully inducing and enabling users to (appropriately) enrich their use of already-installed IT-enabled work systems during the post-adoption stage." (p. 526)

- "The desirability to accommodate both organizational and individual levels of analysis is particularly important with complex IT enabled work systems, such as ERP systems."   (p. 533)

- "All too often, the active management of the implementation of an IT-enabled work system essentially halts after its installation as the key principals involved in the implementation (i.e., business and project managers, IT and business experts, etc.) are either reassigned to other projects or move on to what they consider more pressing activities." (p. 548)

In the first statement, the meaning of users expanding "their use of installed IT-enabled work systems" is unclear. One might expand use of a technology or a technology feature, but not clear how a "user" might use a work system that by definition consists of organizational members, work tasks, and work processes. The sentence probably intended to say that organizations need aggressive tactics to encourage IT users to expand their use of installed technology features. But that interpretation of the sentence would imply that a work system is a technology.

The second statement's reference to "already-installed IT-enabled work systems" seems to have the same meaning. Similarly, the fourth statement seems to say that an IT-enabled work system is both implemented and installed. It seems likely that installation actually refers to hardware and software, and the implementation refers to the new work system, including new work practices. Using a search by Adobe Acrobat, the article uses the phrase "installed IT applications" five times and "installed IT-enabled work systems" twice.

The third statement says that ERP is a complex IT-enabled work system. It is questionable whether ERP fits the JCZ definition of a work system given in Table 1, i.e., organizational members, work tasks, work processes, social structure, incentives, and so on. ERP is software that is purchased, configured and installed. ERP touches and/or controls many different work systems, such as work systems for entering orders and for scheduling production. Considering ERP a work system would combine a very large number of diverse work roles, tasks, processes, and social structures into something too complex to describe or analyze as a single work system. Someone using the WSF definition would say that ERP software is part of an organization's technical infrastructure that integrates numerous work systems.

Thus, several omissions in the JCZ definition of work system may affect the conceptualization of post-adoptive behaviors in Figure 1. Also, the nature or form of the definition may lead to some confusion about the distinction between IT-enabled work systems and IT applications. The next

section goes a step further by proposing an alternative model of post-adoptive behaviors that places work system concepts in the foreground.

III. AN ALTERNATIVE MODEL THAT EMPHASIZES WORK SYSTEM COMPONENTS

The JCZ article focuses on the following research question:

> "What influences current users of installed IT applications to learn about, use, and extend the full range of features built into those applications?" (p. 526)

Based on a thorough review of the literature, the article identifies "three aspects of post-adoptive behavior that have not been fully addressed in prior research: prior use, habit, and a feature-centric view of technology." Next it develops "a conceptualization of post-adoptive behavior characterized by ongoing, dynamic interactions between two levels: one level representing individual cognitions and the other representing organizational drivers that stimulate these individual cognitions." (p. 527).

As expressed in Figure 1, the JCZ conceptualization of post-adoptive behavior includes the term work system at the organizational action level in a feedback loop involving work system outcomes, work system sensemaking, and work system interventions (which feed back into work system outcomes). In other words, the term work system appears in the conceptualization, but the conceptualization focuses on cognitions and feedback, and does not make direct use of concepts within the definition of work system.

Figure 2 presents an alternative model of post-adoptive behaviors that emphasizes the elements of a work system. The model expands the JCZ research question so that it is slightly more general:

> "What influences users of currently installed IT applications to change their use of technology features?

The changes might involve using currently unused features that seem beneficial or discontinuing use of features that seem unnecessary or inappropriate. There is no reason to assume that new use of previously unused features is desirable or that new use of previously unused features is more beneficial than terminating use of features that should not be used.

The model in Figure 2 is simpler than JCZ's two-part model in Figure 1. The alternative model says that incentives plus performance gaps related to work system elements drive intentions to experiment with starting or discontinuing use of particular technology features. The results of the experiments determine which features are adopted, expanded, added, or turned off. The impacts on personal and organizational performance feed back into performance gaps in the future.
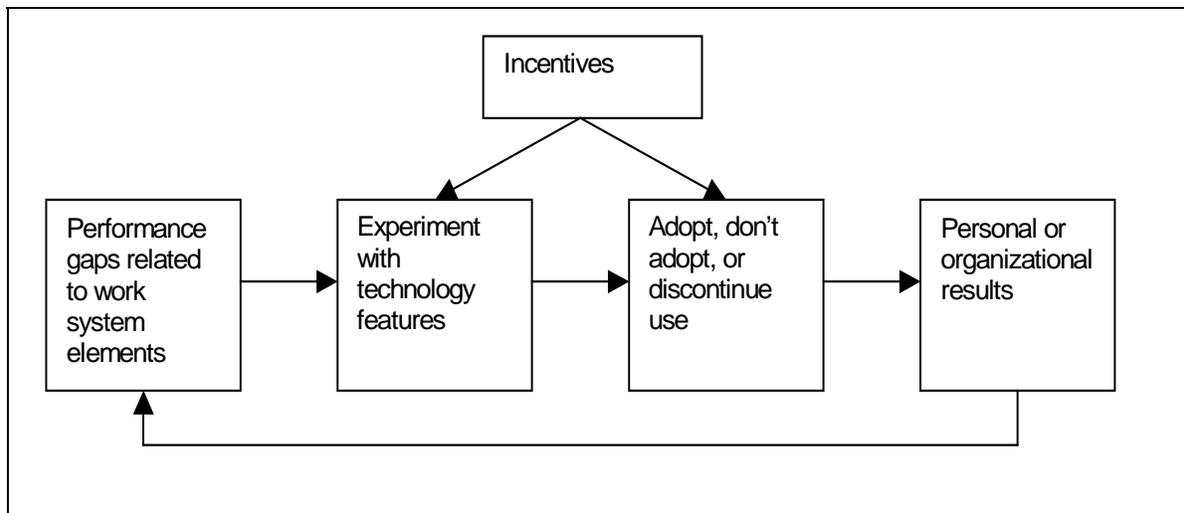
Figure 2. Simple Model of Post-Adaptive Behavior Based on Work System Performance Gaps

The model in Figure 2:

- Assumes that the work system is in the foreground and that performance gaps related to the elements of the work system are the main drivers of decisions about which technology features to use or ignore.

- Ignores important threads of behavior discussed by JCZ, pp. 533-534, such as issues related to prior use, habituation, punctuated equilibrium, and deep structure. Therefore the alternative model does not serve all of the purposes of the JCZ model, which is designed to support intensive research related to those threads of behavior.

- Collapses the distinction between the organizational action model and the individual cognition model.

- De-emphasizes factors in the individual cognition model such as individual attention, individual cognitions, individual differences and user-initiated learning interventions. Those factors are important for intensive research about mechanisms of incremental technology adoption choices. In contrast, the model in Figure 2 places more emphasis on the role of performance gaps and the needs of the work system.

- Ignores the distinction between mandatory and voluntary use of specific features. Instead, the model assumes that features will be tried out and used based on needs of the work system and based on perceived benefits to whomever (manager or hands-on user) is making the decision about whether to use them.

Figure 3 extends Figure 2 by introducing the first layer of the WSF definition. It leaves the model's structure unchanged but expands the model to include a number of typical performance indicators directly related to the nine elements of the work system framework. This model uses generic performance indicators to help in identifying performance gaps that can lead to changes in use of technology features. Here are some typical questions to ask:

- If performance gaps exist, which gaps had the most influence on decisions to change?

- If performance gaps exist and no attempt was made to experiment with features, why was nothing attempted?

- If no performance gaps existed or none were recognized, why were post-adoptive experimentation and/or changes undertaken?
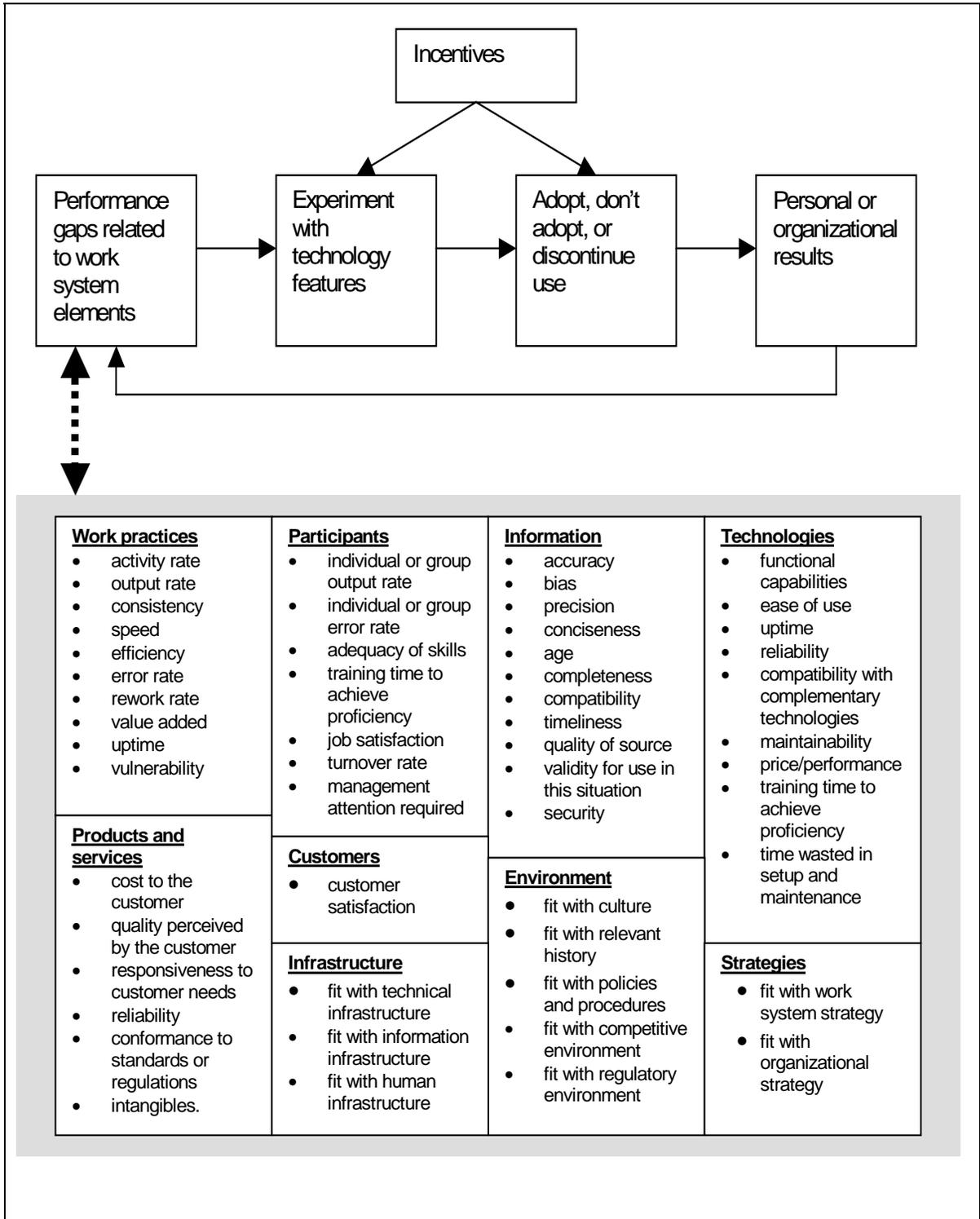

Work practices
- activity rate
- output rate
- consistency
- speed
- efficiency
- error rate
- rework rate
- value added
- uptime
- vulnerability

Products and services
- cost to the customer
- quality perceived by the customer
- responsiveness to customer needs
- reliability
- conformance to standards or regulations
- intangibles.

Participants
- individual or group output rate
- individual or group error rate
- adequacy of skills
- training time to achieve proficiency
- job satisfaction
- turnover rate
- management attention required

Customers
- customer satisfaction

Infrastructure
- fit with technical infrastructure
- fit with information infrastructure
- fit with human infrastructure

Information
- accuracy
- bias
- precision
- conciseness
- age
- completeness
- compatibility
- timeliness
- quality of source
- validity for use in this situation
- security

Environment
- fit with culture
- fit with relevant history
- fit with policies and procedures
- fit with competitive environment
- fit with regulatory environment

Technologies
- functional capabilities
- ease of use
- uptime
- reliability
- compatibility with complementary technologies
- maintainability
- price/performance
- training time to achieve proficiency
- time wasted in setup and maintenance

Strategies
- fit with work system strategy
- fit with organizational strategy

Figure 3. Performance Gap Model with Common Performance Indicators

The model in Figure 3 identifies specific, work system-related performance gaps to be traced by empirical research. Such research explores the relative importance of different performance gaps, and leads to identifying other gaps within each work system element. Alternatively, it might discover flaws in a basic assumption underlying the models in Figure 1, 2, or 3; it might discover that experimentation with unused technology features is only vaguely associated with work system outcomes in many cases.

Regardless of how the alternative models in Figure 2 and Figure 3 are improved, a model that emphasizes performance gaps or perceived needs of the work system highlights issues that users, managers, and IT professionals can observe more easily than they can observe cognitions and sensemaking. I believe some version of the alternative models would likely lead to practical methods and tools that can help business and IT professionals make better decisions about whether or not to use specific capabilities of IT applications. In particular, such methods and tools would be especially helpful when usage patterns are stable and currently used technology features are not causing obvious problems. People with curiosity, imagination, and ambition generated IT usage innovations in many such situations. A model highlighting the potential applicability of dormant IT features in a work system might be helpful for such activities.

The JCZ article refers to a number of important challenges for research methodology including issues related to core versus ancillary features and discrete features versus bundles of features (p. 547). Placing the work system in the foreground in the model helps in conceptualizing these and similar topics.

From a business viewpoint, improving work system performance is the true goal, rather than increasing usage of IT features. Although post-adoptive behaviors are important for understanding diffusion and success of specific technologies within organizations, from a work system viewpoint the discussion of post-implementation adaptations should be broader. It should include some adaptations related to IT features and some not related to IT features, such as new procedures, new incentives, or staffing changes. From a work system viewpoint, focusing solely on adaptations related to IT features and downplaying other adaptations seems an unnecessary and possibly counterproductive bias.

IV. CONCLUSION

This article explored whether the definition of work system (or IT artifact) actually matters. It demonstrated that a different definition of work system highlights issues about information beyond those in JCZ. It inferred from JCZ's multiple use of the term work system that the nature or form of the JCZ definition may be problematic. It presented an alternative model of post-adoptive behaviors that emphasized performance gaps related to work system elements, showing that a different definition of work system leads to a different model.

Whether or not you were convinced by this article's observations about the importance of certain definitions, please remember that its goal is not to criticize main points in the JCZ article. That article's use of the term work system, rather than IT artifact, provided an opportunity to look at whether and how definitions of work system or IT artifact actually matter. As discussed in Section I, the definition of work system is tangential in the JCZ article, whose main goal and very useful contribution involved compiling, organizing, and extracting meaning and implications of research related to post-adoptive behaviors.

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ABOUT THE AUTHOR

Steven Alter is Professor of Information Systems at the University of San Francisco. He holds a B.S. and Ph.D. from MIT. He extended his 1975 Ph.D. thesis into one of the first books on decision support systems. After teaching at the University of Southern California he served for eight years as co-founder and Vice President of Consilium, a manufacturing software firm that was acquired by Applied Materials in 1998. His research concerns developing systems analysis concepts and methods that can be used by typical business professionals and can support communication with IT professionals. His new book is called *The Work System Method: Connecting People, Processes, and IT for Business Results*. His articles appear in *Harvard Business Review, Sloan Management Review, MIS Quarterly, European Journal of Information Systems, Decision Support Systems, Interfaces, Communications of the ACM, Communications of the AIS, CIO Insight, Futures, The Futurist,* and many conference transactions.

LETTERS TO THE EDITOR

Letter to the Editor from P.E. Carter, `J.Jasperson, and R.W. Zmud with a reply from S. Alter

FROM: **Pamela E. Carter**
        Florida State University

        `Jon (Sean) Jasperson
        Texas A&M University

        Robert W. Zmud
        University of Oklahoma

DEFINING IT-ENABLED WORK SYSTEMS: RESPONSE TO ALTER

ABSTRACT

Alter [2006] critiques our definition and use of the term "work system" in Jasperson, Carter, and Zmud [2005]. We respond to his conclusions by focusing on our conceptualization of work systems, of which the definition is only one part. In addition, we reemphasize and clarify our definition of work systems and discuss where we believe Alter misinterprets our work.

Keywords: IT-enabled work systems

I. INTRODUCTION

Yes, definitions do matter. Alter [2006] "looks in detail at whether the definition of work system mattered in Jasperson, Carter, and Zmud's [2005] article in *MIS Quarterly* about post-adoptive behaviors" (p. 1). Alter concludes:

1. our (JCZ) definition affected our conceptualization of post-adoptive behaviors and

2. using his (WSF) definition would have improved our article.

Regarding the first conclusion, we happily agree. Conceptualizations are supposed to be affected by the definitions upon which they are based. Hence, given Alter's rigorous inspection, this is a positive outcome. However, we must disagree with his second conclusion. Using the WSF definition would not necessarily have resulted in a more (or less) effective paper – but, it most likely would have produced a different paper. The primary reasons we disagree with the second conclusion follow from our agreement with the first conclusion. We elaborate our position on both points in an effort to clarify any misinterpretations of our work as well as to offer additional thoughts on the role of construct definitions in theoretical conceptualizations.

II. DEFINING IT-ENABLED WORK SYSTEMS

Alter states that our article may have been improved had we used his WSF definition of work systems. He then outlines how his WSF definition and our JCZ definition differ. We would like to suggest that the WSF and JCZ definitions may not be as different as is implied. In Table 1 we "match" the components of each definition that we believe reflect similar elements.

As can be seen from the table, we believe the similarities are greater than differences in these two work system definitions. Only the asterisked JCZ element does not have a corresponding WSF element. Further, in comparing our work to his, Alter [2006] identifies the JCZ definition of work system as having several weaknesses. In many of these comparisons, we believe Alter misinterpreted our work. We attempt to clarify some of these misinterpretations below.

Participants and Customers -- Alter [2006] argues that the JCZ definition is not sufficiently robust with respect to the broad range of participants, such as customers, involved within a work system (p. 8). While we explicitly mention "an organization's members" as "core elements" of the work system, we do not exclude other participants. In fact, we discuss other participants both internal and external to the organization as being peer and/or expert intervention sources and thus implicitly associated with the work system. Thus, our definition does recognize the existence and involvement of other "non-user" participants on post-adoptive behaviors and, hence, on the work system. Also, it should be noted that in the WSF definition customers – and the other elements labeled with an (e) in Table 1 – are not a part of the work system. Instead, Alter states that they are elements outside of the work system that should be considered in order to achieve a "basic understanding of a work system." In other words, they are a part of the WSF work system conceptualization, but not a part of the definition. We will return to this point in Section III of our response.

- **Information** -- The WSF definition indicates "information includes codified and non-codified information used and created as participants perform their work" (p. 9). Although information is not explicitly discussed, the vital role of information (as well as data and knowledge) is implied in our description and discussion of technology sensemaking, work system sensemaking, and work system outcomes (see p. 535-536; 540-542). We believe that individuals engaged in sensemaking regarding their performance of work tasks and associated technology use must incorporate both codified and non-codified information into their work lives and, hence, into their cognitive processing.

Table 1. Work System Definitions

WSF Definition	JCZ Definition
System in which (a) – human participants and/or machines (b) – perform work (c) – using information, technology, and other resources (d) – to produce products and/or services for internal or external customers	Represents the context within which (a) – organizational members (b) – perform their assigned work.
Elements of Work System: (b) – work practices (a) – participants (c) – information (c) – technology	Work System Includes: (a) – organizational members (b) – work tasks undertaken by members (b) – work processes (c) – technology features that enable or support work tasks and processes (*) – social structures that direct organizational members both in their work relationships, behaviors, and interactions with each other
Elements not directly a part of a work system, but important to the conceptualization of the construct: (e) – products/services produced (e) – customers (e) – environment (e) – external infrastructure that the work system uses (e) – strategies within which the work system operates	Processes not directly a part of a work system, but important to the conceptualization of the construct: (e) – work system sensemaking

- **Products and services** -- Our focus on post-adoptive behaviors led us to a lesser emphasis on the products and services produced by a work system. However, "work system sensemaking occurs via observations regarding work system outcome expectation gaps" (p. 535). In other words, outcomes of the work system are considered. These outcomes are compared to prior expectations. Then, a "work system outcome expectation gap represents the difference between desired and perceived work system outcomes" (p. 536). In our focused discussion on post-adoptive behaviors, we limited our discussion to "work system outcomes that arise...as a result of applying IT application features in the conduct of organizational work" (p. 535). However, the JCZ definition does not preclude the influence of other aspects of work system output, e.g., products and

services, in either the organizational action sub-model or the individual cognition sub-model of post-adoptive behavior.

- **Environment** – In Table 1, the WSF definition starts with identifying the work system as a "system." In our conceptualization, the work system represents the "context" in which post-adoptive behaviors occur. Given our focus on post-adoptive behaviors within this context, we limit our discussion of environment to the immediate work environment. This difference is important in the WSF and JCZ conceptualizations of work system. We will return to this point in Section III of our response.

Alter [2006] concludes that the JCZ work system definition has several omissions that limit our conceptual model. And this is correct; our definition does help us to limit the scope of our conceptual model. While focusing intently on definitional differences, Alter does not consider that this limitation may in fact be a purposeful aspect of our conceptualization effort.

As described above, when our definition of work system is taken in the context of the overall post-adoptive behavior conceptual model, our definition of work system does not have as many omissions (in relation to the WSF definition) as Alter implies. Our description of sensemaking, at the work system and technology levels, and our discussion of intervention sources are sufficiently robust that the JCZ definition can be interpreted as supporting the WSF definition.

Alter [2006, p. 17] offers a conceptual model that "emphasizes the elements of the work system" and "is simpler than JCZ's two-part model" (p. 17). Alter's model is at a much higher level of abstraction. Indeed, Alter refers to his alternative as a "Simple Model of Post-Adaptive [sic] Behavior Based on Work System Performance Gaps." Unfortunately, as the constructs are largely undefined and the relationships unexplained, it is difficult (if not impossible) to judge whether this proffered model represents an improvement or distraction to our model.

As recognized by Alter, the definition of work system was tangential to our stated goal of defining and explaining post-adoptive behaviors. Thus, we do not agree that the "limitations" of our definition noted by Alter inhibit our meeting the stated goals and objectives of our work. Our conceptualization of work systems *might* be seen as limited if it was inserted into a research context where the stated goals and objectives required a much broader view of work systems, as in the highly abstracted alternative model provided by Alter. Still, we continue to view our post-adoptive behavior model as a very useful conceptualization that can be used to extend the work system life cycle model as proposed by Alter [2006, p. 6].

III. CONSTRUCT DEFINITIONS AND CONCEPTUALIZATION

While we have argued that the definitional differences highlighted by Alter are not as extreme as might otherwise be interpreted from his article, we do believe there are important differences between the two work system construct conceptualizations that Alter did not acknowledge. Definitions do matter; however, definitions are only one aspect of conceptualizing a research construct. Other important facets of construct conceptualization include dimensionality, process and/or variance characteristics, level(s) of analysis, and level of abstraction. It is the conceptualization as a whole that specifies meaning and takes into account the boundary conditions under which the construct exists. Taking one facet of a conceptualization (e.g., the definition) and substituting it for the same facet type in a different conceptualization will undoubtedly lead to a difference in specified meaning for the conceptualization as a whole. Alter argues that making this type of definition substitution is not only appropriate, but would improve our article. We disagree. In this instance, we do not believe substituting our definition for his, or vice versa, is appropriate because the goals and objectives that underlay these two efforts at work system conceptualization are entirely different. This is why we believe substituting the WSF definition in our work would have led to a different, but not necessarily better or worse, article.

We highlight just a few important differences in our work system conceptualizations to make our point.

- **Goals/Objectives** – The differences in the goals and objectives of Alter's work and our work are key, since all facets of construct conceptualization are (or should be) driven by the goals and objectives of the research effort. Alter's work focused on defining and refining the conceptualization of work systems. His work provides a static view, where nine elements of the WSF serve as an outline for "understanding or analyzing a work system" and "drilling down into important issues." His work also provides a dynamic view "summarizing how work systems change over time." Alternatively, the goals and objectives of our work – as Alter himself notes (p. 6) – focused on conceptualizing post-adoptive behaviors as opposed to theorizing about work systems.

- **Definition** – In the WSF conceptualization, the work system is defined as the focal object, which makes sense given the goals and objectives of Alter's research. Not only does Alter define the four primary elements of a work system, he also defines five elements external to the work system that are "part of even a basic understanding of a work system" (p. 6) (see Table 1). Clearly his goal is primarily to theorize about work systems. In the JCZ conceptualization, however, the work system is defined as the context in which post-adoption behaviors exist. Here the work system is not the focal object. Instead, it is defined as the context for the focal object (i.e. post-adoptive behaviors), which makes sense given the goals and objectives of our research.

- **Level of Abstraction** – In the WSF conceptualization, the work system is presented at a high level of abstraction. Given the goals and objectives of Alter's research, this makes sense. Providing an "outline" that allows for:

  1. understanding a system consisting of four high level elements as well as five additional high level elements external to the work system (Table 1) and

  2. "drilling down" into important issues requires a high level of abstraction.

In the JCZ conceptualization, however, the work system is presented at a lower level of abstraction because it was necessary to link individual level cognitions to the context of a work system. Given our lower level of abstraction, we limited the scope of what we discussed as being included in the work system. (This is also a primary rationale for our focus on technology features as opposed to treating technology as a black box.)

Alter asks whether "the JCZ definition truly supported the attempt to conceptualize post-adoptive behaviors" (p. 12). In response, we emphatically state that

  1. the JCZ definition did support our efforts to conceptualize post-adoptive behaviors and

  2. the WSF definition, in our view, would not have supported our efforts to the same extent.

Perhaps Alter's focus on different goals and objectives led him to the different opinion.

Finally, Alter pulls four statements out of our article as examples, where "use of the term work system seems inconsistent with the JCZ definition of work system" (p. 14). In all four instances, the problem seems to center on our use of the terms "installed," "implemented," and "IT-enabled" work systems. Alter states that we seem to be using the term work system as if we really meant application. After reading the sentences out of context, we can see how Alter arrives at this conclusion. However, for the sake of argument, we ask you to consider: What if we did mean for our readers to interpret the statements as referring to our definition of work system? What would be the meaning of the statements given this assumption?

In the JCZ definition, the work system represents the context in which organizational members perform their assigned work. The work system itself includes organizational members; work tasks undertaken by members; work processes; technology features that enable or support work tasks and processes; and social structures that direct organizational members both in their work

relationships, behaviors, and interactions with each other. Can these work systems be IT-enabled? Yes, we believe there can be ready agreement that technology features that enable or support work tasks, processes and social structures would make a work system capable of being IT-enabled.

Now for the trickier question. What might it mean for these work systems to be installed and implemented? First, one must recognize work systems as being artificial in the sense that organizational members (e.g. management) bring various components together in ways such that work goals and objectives will be accomplished. If one takes a systems approach to the problem, work systems, like any other type of artificial system, can be designed [Simon, 1996]. Following this line of thinking, once designed, work systems can be said to be installed and implemented. So, for example, an ERP work system would be all of the work system components (not just the software application components) brought together to focus on the "broad set of activities supported by multi-mode application software that helps a manufacturer or other business manage the important parts of its business" [whatis.com, 2005]. Using this view, the design, installation and implementation of an ERP work system could be examined, providing a unique (and holistic) research perspective.

IV. CONCLUSION

We sincerely thank Alter for his compliments on our article and for recognizing our efforts to expand the conceptual view of post-adoptive behaviors as inclusive of work systems. Additionally, we commend Alter for his efforts in critiquing our research and demonstrating how to link our more specific work on post-adoptive behaviors to his more general research on work systems. Alter's [2006] thoughtful critique has provided an opportunity for us to clarify our work and, more importantly, provided a forum for IS researchers to extend their own thinking about the conceptualizations of work systems and their application to IS phenomena. For example, Alter's recommendations as presented in his Figure 3 (p. 19) are an excellent starting point for suggestions regarding how to measure work system performance gaps. We look forward to reading other published work in the IS domain that addresses important work system issues.

REFERENCES

Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web, can gain direct access to these linked references. Readers are warned, however, that
1. these links existed as of the date of publication but are not guaranteed to be working thereafter.
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ABOUT THE AUTHORS

Pamela E. Carter is Assistant Professor of MIS in the College of Business at Florida State University. Her research interests include the diffusion of complex technologies, meanings and interpretations of and within information systems, collaborative project management, and IS infrastructure management. She received her Ph.D. from Florida State University and her M.B.A. from the University of Maryland.

`**Jon (Sean) Jasperson** is Clinical Assistant Professor for the Information and Operations Management Department in the Mays Business School at Texas A&M University. His research interests include the adoption, use, management, and implementation of information technology in organizational settings. He received his Ph.D. from Florida State University.

Robert W. Zmud is Professor and Michael F. Price Chair in MIS, Division of MIS, Michael F. Price College of Business, University of Oklahoma. His research interests focus on the organizational impacts of information technology and on the management, implementation, and diffusion of information technology. He is a Senior Editor with *Information Systems Research* and with the *Journal of AIS*, and he currently sits on the editorial boards of *Management Science*, *Academy of Management Review,* and *Information and Organization*. He holds a Ph.D. from the University of Arizona and a M.S. from M.I.T

Response by the Author
Steven Alter
University of San Francisco

DEFINING IT-ENABLED WORK SYSTEMS: RESPONSE TO LETTER BY CARTER, JASPERSON, AND ZMUD

I want to thank Carter, Jasperson, and Zmud (CJZ) for engaging in this discussion of definitions of basic terms discussed in their *MIS Quarterly* article [Jasperson, Carter, and Zmud, 2005] and in my *CAIS* article presented above [Alter, 2006] responding to one aspect of their article. I believe that serious inquiry related to basic definitions is important in the IS discipline, especially given the longstanding concerns about rigor and relevance.

At the outset I want to say that I agree partially with a statement in the first paragraph in the CJZ letter, "Using the WSF definition would not necessarily have resulted in a more (or less) effective paper – but, it most likely would have produced a different paper." Because the definition of work system was not a central topic in the JCZ paper, I agree that "using the WSF definition would not necessarily have resulted in a more (or less) effective paper." The JCZ paper made a valuable contribution by highlighting many issues in an important, but under-researched area. I doubt that use of the WSF definition would have had any significant impact on either the flow or the primary contributions of the JCZ paper. However, I also believe that defining a work system as a system, rather than a context, might have led to additional observations and insights. In addition, I agree that the JCZ "post-adoptive behavior model [is] a very useful conceptualization that can be used to extend the work system life cycle model" that I proposed elsewhere.

Work system: a system or a context? The top part of Table 1 in the CJZ letter restates something basic about the two definitions of work system. The WSF definition states that a work system is a system. The JCZ definition states that a work system "represents the context within which organizational members perform their assigned work." The article's title, "A

Comprehensive Conceptualization of Post-Adoptive Behaviors Associated with Information Technology Enabled Work Systems," sounds as though work systems are systems rather than contexts. It is possible to define a work system as a context for something else, but if JCZ meant it was a context, I don't understand why they called it "work system" instead of "work context" or just "context" for post-adoptive behaviors.

In the JCZ definition, a work system (which is a context) includes "organizational members, work tasks undertaken by members, work processes, technology features that enable or support work tasks and processes, and social structures that direct organizational members both in their work relationships, behaviors, and interactions with each other."   If that is the context, what is the system that operates within that context? Wouldn't a system within that context contain the same elements? If so, what would be the difference between the system and its context? If not, what is the value of distinguishing between the system and its context?

Work system elements. The intention in developing WSF and related conceptualizations was to help any business or IT professional use a work system metaphor as a lens for understanding systems in organizations regardless of whether IT is involved. The need to focus on IT-reliant work systems (rather than just information systems or IT applications) became apparent based on shortcomings in group term papers written in the 1990s by MBA and EMBA students attempting to analyze real world systems in their own organizations in order to produce business-oriented recommendations.

The nine WSF elements were developed and modified iteratively over many years. Although I agree with CJZ's statement that "the vital role of information (as well as data and knowledge) is implied in [their] description and discussion of technology sensemaking, work system sensemaking, and work system outcomes," I think they may find benefits from including information explicitly. Information is one of the nine WSF elements because many of the problems in work systems are related to inadequate information and some opportunities are related to information currently unused. Years of experience with a large number of MBA and EMBA students showed surprisingly little ability or desire to follow implicit or implied paths in self-directed analysis projects. Including information as one of the elements helps them pay attention to issues related to information. I assume that experience with the MBA and EMBA students is at least somewhat relevant to practitioners and researchers attempting to understand post-adoptive behavior.

Similarly, one of the original reasons for viewing a work system as the unit of analysis, not an information system or IT application, was that business results come much more directly from work systems than from IT capabilities that happen to exist within those systems. Including products and services and customers as elements within WSF made it clearer to MBA and EMBA students that a techno-centric analysis focusing on IT capabilities is inadequate as a business analysis of a system in an organization. Based on that experience, I remain convinced that the explicit inclusion of information, products and services, and customers would make the JCZ definition of work system more useful to researchers and practitioners (regardless of whether the definition refers to a context or a system).

Uses of the term work system that are inconsistent with the definition. Consider the first of the examples that I cited in my paper.   JCZ's Abstract states (p. 525), "We argue that organizations need aggressive tactics to encourage users to expand their use of installed IT-enabled work systems." According to the JCZ definition, a work system is a context. A context might be IT-enabled, although I doubt most people would talk about IT-enabled contexts. Also, I doubt most people would talk about the use of IT-enabled contexts. Usage (in the typical sense of the words in the sentence) refers to hardware and software, not work systems by either definition.

Additional nit-picking about this sentence or several others would not add anything. Ideally, important terms should be named and defined in a way that minimizes the likelihood of confusion or misuse.

Does the definition matter? We agree that definitions matter. As mentioned at the outset, I doubt that use of the WSF definition would have had any significant impact on either the flow or the primary contributions of the JCZ paper. I think that the article's very useful exploration of post-adoptive behavior did not rely on the definition of work system, but that the WSF definition might have been more useful in leading to the identification of additional topics and issues.

In the broader scheme of things, I believe that inconsistent definitions of basic terms create an obstacle to making sense of the IS literature. Table 1 in Alter [2006] was included to illustrate this problem by showing different, somewhat overlapping definitions of IT artifact and work system that appeared in leading journals in the last five years.

A final similarity. I also want to mention a similarity (and possible area of agreement) related to information systems per se. The WSF approach to understanding IT-enabled work systems assumes that the inclusion of IT in a work system does not make the work system an information system. For example, a sales work system that happens to use CRM software is fundamentally a sales system, not a CRM system nor an information system, an IT system, or an IT artifact. Similarly, a package delivery system that that includes IT-enabled tracking of packages is fundamentally a package delivery system, not an information system.

I assume that the JCZ article adopted a somewhat similar stance based on its use of IT-enabled work system rather than information system in its title and based on the fact that the term information system did not play a substantive role in the article. An Adobe Acrobat search of the JCZ article found 48 instances of the term "information system" in text paragraphs, tables, references, or author biographies. Of those, the two in the text mentioned "information system researchers and practitioners" (p. 526) and the "information system field" (p. 527). The list of examples in Table 2 (p. 530) included three examples described by the term information system. All of the other instances appeared in the references at the end of the article or author biographies.

Although one may prefer the WSF definition or the JCZ definition of work system, the explicit and implicit overlaps noted in the CJZ letter reflect what I hope is agreement about a rather general issue in the IS discipline. Understanding and analyzing the operation and evolution of IT-enabled systems in organizations involves something broader than just information systems per se or IT applications. Viewing IT-enabled work systems as the unit of analysis (regardless of the precise definition) helped Jasperson, Carter, and Zmud produce a valuable article revealing topics for future research about post-adoptive behaviors. I was pleased to see the term IT-enabled work system in the JCZ title because I believe that IT-enabled work systems have become the core subject matter of the IS discipline. I hope Jasperson, Carter, and Zmud agree.

REFERENCES

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