# Sociotechnical Systems through a Work System Lens: A Possible Path for Reconciling System Conceptualizations, Business Realities, and Humanist Values in IS Development*

Steven Alter

University of San Francisco

alter@usfca.edu

**Abstract.** This position paper describes an approach that might increase the likelihood that the sociotechnical perspective will take its proper place in today's world. This paper questions the clarity of the traditional STS notion of joint optimization of a social system and technical system. It explains how the integrated system view in work system theory (WST) and the work system method (WSM) might provide a more straightforward way to describe, discuss, and negotiate about sociotechnical systems. Using WST/WSM to bypass the effort of separately describing and jointly optimizing social and technical systems might make it easier to engage effectively in discussions that reconcile system conceptualizations, business realities, and humanist values in IS development.

**Keywords:** sociotechnical system, sociotechnical design, joint optimization of social and technical systems, work system theory, work system method

## 1 Does existing sociotechnical thinking need an update?

The CFP for STPIS 2015, the 1st International Workshop on Socio-Technical Perspective in IS Development, says that the socio-technical perspective "is often forgotten in the Information Systems (IS) discourse today." … "We strongly believe that it is high time the social-technical perspective took its proper place in IS research, practice and teaching." An article [1] by the late Enid Mumford that is posted on the STPIS 2015 webpage describes the approach.

> "Throughout its history, practitioners have always tried to achieve its two most important values: the need to humanize work through the redesign of jobs and democracy at work. In order to realize these goals, the objective of socio-technical design has always been 'the joint optimization of the social and technical systems'. Human needs must not be forgotten when technical systems are

* This is an abbreviated version of a longer paper that is available at www.stevenalter.com. The longer version provides more background about work system theory and more complete explanations that could not be included in this abbreviated version.

> introduced. The social and the technical should, whenever possible, be given equal weight." … "The most important thing that socio-technical design can contribute is its value system." … "This tells us that although technology and organizational structures may change, the rights and needs of the employee must be given as high a priority as those of the non-human parts of the system."

After summarizing the history of sociotechnical thinking, [1] expresses doubts and disappointment about its limited influence in today's world. This leaves the question of what might be done to help that perspective take its proper place. Voicing doubts from other viewpoints, [2] explores whether the academic IS discipline has been faithful to the traditional sociotechnical paradigm and [3] asks whether the organizational "container" is sufficient for describing sociotechnical work in the 21st century.

**Goals and organization**. This paper presents ideas that might help the sociotechnical perspective take its proper place in today's world. It explains why the frequently mentioned joint optimization of social and technical systems is difficult to apply analytically. It summarizes how work system theory (WST) and the work system method (WSM) provide a broadly applicable lens for understanding and designing sociotechnical systems. It also mentions potential benefits of using that approach.

## 2 Problematic STS Terminology as an Obstacle to Applications

Despite coverage of sociotechnical themes in the first volume of *MIS Quarterly* (e.g., [4]), sociotechnical analysis and design methods have not been prominent in the IS discipline or in IS practice. [1. pp. 321-322] describes such methods as follows:

> "The objective of socio-technical design has always been 'the joint optimization of the social and technical systems." …. "Relationships between the two systems, and between them and the outside environment, must also be carefully analysed. This approach led to the development of a complex method for analysing work systems, which went through a number of stages. Unit operations, or groups of tasks that fitted logically together into a discrete work activity, were first identified. Each of these unit operations was made the responsibility of a work group. Next, variances – problem areas where what did happen deviated from what should happen – were noted as areas for improved control by the work group. Supporting activities such as maintenance and the acquisition of supplies were also brought into the analysis. All of these were to become the responsibility of the work group."

Aside from the complexity of that approach, a fundamental problem is that *social system*, *technical system*, *work system*, and *joint optimization* are not defined clearly. While practitioners and researchers in the sociotechnical community might take these terms for granted, lack of definition for basic concepts cannot help in explaining this approach to the un-initiated, which is an essential step toward STS taking its proper place in IS research, practice, and teaching.

A possible reason for the lack of clear definition is that the separation between the social system and technical system is largely artificial, as revealed in Figure 1 in [4], which says that the social subsystem includes structure and people, whereas the tech-

 

nical subsystem includes technology and tasks. (Arrows link each pair of those four elements in Figure 1 in [4].) Those distinctions are questionable in many situations.

**Is "Task" technical or social?** A business process can be viewed as an abstract specification of the steps in performing work. It seems natural to treat those activities as a technical system if machines perform the work, but it is hard to separate the social from the technical if people perform the work. For example, an ethnographer looking at a business process would observe that some effort goes into performing specified steps, while other effort goes into coordination, "articulation work," and other activities that are not documented as part of the process. That other effort is clearly social, yet it is an essential part of "the technical system."

**Is "Structure" technical or social?** Structure-in-practice (assigned to the social system in Figure 1 in [4]) is a reflection of how tasks (assigned to the technical system) are performed, not just the boxes on an organization chart. Structure may seem social at first blush, but it is increasingly controlled and/or constrained by the capabilities and limitations of technologies such as ERP software and networks.

**Is "Information" technical or social?** The ambiguous status of information (not mentioned in Figure 1 in [4]) contributes to the lack of clarity in the separation between the social and technical. Some information that is stored in computerized databases is easily recognized as part of a technical system, especially if the data was created automatically. Other types of information that are essential for performing work are obviously social, such as conversations, commitments, goals, rules and regulations, institutional memory, and other types of non-computerized information.

**Is "Technology" technical or social?** With the widespread use of personal computing devices and smart phones, and with the trend toward BYOD (bring your own device), social aspects of the acceptance and use of technology are increasingly important in sociotechnical systems.

**What does joint optimization mean?** Difficulty defining or separating social and technical systems makes the notion of joint optimization highly problematic. The concept of optimization does not fit well with organization design because the plethora of relevant factors makes it unlikely that anyone would try to find a genuinely optimal solution. (Why talk about optimization if that is an impossible dream?) A more appropriate term is Herbert Simon's concept of "satisficing", i.e., finding a satisfactory solution that is acceptable to most stakeholders and that allows the organization to move forward. Instead of an image of optimization, a more appropriate image is "fit" or "alignment", or in some situations, "negotiated truce." Thus, at least in my personal opinion, collaborating and negotiating about social impacts of processes and technologies in work group and stakeholder meetings is not really a form of optimization.

**Is the joint optimization of social and technical systems easy to teach and learn?** While full participation of work groups seems an important part of the STS approach, the previously quoted description of sociotechnical design says it is a "complex method for analysing work systems, which went through a number of stages." In other words, complexity could be an obstacle to broader use of sociotechnical design. In turn, that leads me to wonder whether most STS design is actually done by consultants who obtain information from work groups rather than by work groups themselves, which seems more in line with the values of the STS movement.

## 3 Overview of Work System Theory (WST) and the Work System Method (WSM)

Thinking of sociotechnical systems as work systems in the sense of work system theory (WST) and the work system method (WSM) might encourage greater use of sociotechnical ideas and values during IS development, implementation, and use. WST views a sociotechnical system as a work system that is not subdivided into a social system and technical system but whose components may have both social and technical characteristics. A work system is a system in which people and/or machines perform processes and activities to produce product/services for internal and/or external customers. That definition is a step forward because the term *work system* has been used for decades in sociotechnical research without careful definition, e.g., in Volume 1 of *MIS Quarterly* [4], and more recently in [3]. As explained in [5,6,7], WST consists of 1) the definition of work system, 2) the work system framework, which provides a static view of a work system during a period when it is relatively stable, and 3) the work system life cycle model (WSLC), which provides a dynamic view of how a work system changes over time. Applications of WST in WSM and various extensions of WST are summarized in [6].

**Work systems, information systems, and sociotechnical systems**. Work system is a general case for systems in organizations. Work systems are sociotechnical by default, but can be totally automated. Special cases of work systems include:

- Information systems are work systems whose processes and activities are totally devoted to processing information through activities including capturing, transmitting, storing, retrieving, deleting, manipulating, and displaying information.
- Supply chains are inter-organizational work systems that provide supplies and other resources required for business operations of customer organizations.
- Projects are temporary work systems that are designed to produce a set of product/ services, after which they cease to exist.
- Totally automated work systems are work systems with no human participants. People who create and maintain these work systems are participants in other work systems that perform those tasks.

**Work system framework**. This framework is a basis for describing and analyzing IT-reliant work systems in organizations. Its nine elements organize a basic understanding of a work system by outlining a work system's form, function, and environment. Of its nine elements:

- Processes and activities, participants, information, and technologies are viewed as completely within the work system.
- Customers and products/services may be partially inside and partially outside because customers often participate in the processes and activities within the work system and because product/services take shape within the work system.
- Environment, infrastructure, and strategies are largely outside the work system but have direct effects within the work system. (For example, environment includes organizational culture, politics, history, demographics, competition, etc.)

 

**Work system life cycle model**. The WSLC describes how work systems evolve through a combination of planned and unplanned change. It differs fundamentally from the "system development life cycle" (SDLC), which is a project model rather than a system life cycle. Even when current versions of the SDLC contain iterations, those iterations are basically within a project. "The system" in the SDLC is a basically a technical artifact that is being created. In the WSLC it is a work system that evolves through iterations that combine defined projects and incremental changes from small adaptations and experimentation. In contrast to the SDLC, the WSLC treats unplanned changes as part of a work system's natural evolution.

**Work system method**. WSM [5,6,7] is a flexible systems analysis and design method based on WST. It treats the system of interest as a work system. It was created for use by business professionals, and can be used jointly by business and IT professionals in designing work system improvements that may or may not involve software changes. It can be used for high-level guidance in thinking about a work system or can organize a more detailed analysis by using a work system analysis template. It starts from whatever work system problems, opportunities, or issues launched the analysis. A notable aspect of WSM is that the current and proposed systems are work systems rather than configurations of hardware and software.

There are three main commonalities among different versions of WSM. 1) the work system's scope is determined by viewing the work system as the smallest work system that exhibits the problems or opportunities that motivated the analysis. 2) the current and proposed work systems are summarized in the format of a work system snapshot, a one-page summary of the work system's customers, product/services, processes and activities, participants, information, and technologies. 3) performance gaps (variances) are identified and alleviated in relation to both internal metrics such as productivity and external metrics such as quality and cost to the customer.

**Relationship to IS development and systems analysis and design**. Most textbooks on systems analysis and IS development teach that systems are technical artifacts that operate through IT hardware, software, network infrastructure, user interfaces, and databases. IS development is often viewed as creating and installing technical artifacts whose requirements come from analyzing sociotechnical systems. In contrast, a sociotechnical view of "the system" calls for not only technology changes, but also changes in processes, management, training, social relations, and incentives.

Analysis and design from a work system perspective consistent with the WSLC and WSM starts with identifying the smallest work system that has the problems or opportunities that launched the analysis. The "as is" system is a work system that requires improvement. The "to be" system is a work system that is more likely to meet performance goals. The analysis focuses on the structure of the "as is" work system (including processes, participants, technologies, and information) and on addressing performance gaps, key incidents, customer needs, and so on. Six Sigma techniques such as Pareto charts and value stream mapping are just as relevant to work system analysis as IT-oriented methods and social analysis methods. The resulting project proposal outlines activities for moving from the "as is" work system to the "to be" work system.

Finally, consistent with the sociotechnical principle of incompletion (e.g., [1] p. 323), the inward-facing arrows in the WSLC say that emergent change is likely to occur during a work system's natural evolution. Work system designers should not assume that a work system will operate in accordance with idealized specifications after the initial implementation.

# 4 Benefits of Seeing Sociotechnical Systems through a Work System Lens

## 4.1 Benefit #1: Sociotechnical Work Systems Will Be More Understandable

Analyzing and designing sociotechnical systems from a work system perspective eliminates the artificial separation between the social system and the technical system. It also eliminates the misnamed concept of joint optimization. Using a work system lens brings the following benefits:

**A more practical model**. Seeing a sociotechnical system as a single work system is simpler and easier to discuss and analyze than seeing it as a combination of vaguely defined social and technical systems that actually overlap.

**An organized approach to business topics.** The work system framework outlines elements that must be considered in even a basic understanding of a work system. It covers social and technical aspects of the situation without assuming artificial separation of the social and technical which could complicate instead of facilitating.

**A readily usable analysis method**. WSM is an easily adaptable method for performing the initial analysis of a work system, clarifying its boundaries, and attaining agreement about what system is actually being improved. Many hundreds of MBA and Executive MBA students in the United States, China, India, and Vietnam have used WSM templates to produce preliminary management briefings suggesting work system improvements in their organizations (e.g., [8]). The core of WSM can be used at the beginning of agile development projects to clarify goals and direction.

**Usable without consultants or researchers**. Meaningful use of WSM does not require guidance by IT experts, consultants, or researchers even though ideal applications of WSM should involve collaboration between business and IT professionals.

## 4.2 Benefit #2: Analysis and Design Are More Likely to Reflect Business Realities

**Customers**. The placement of customers at the top of the work system framework is a reminder that work systems exist to produce product/services for internal and/or external customers who may be work system participants (e.g., patients in medical exams, users in IS development, students in education).

**Product/services**. Neither customers nor product/services appear in the depiction of social and technical systems in Figure 1 in [4]. Mumford's description of STS (quoted earlier) seems to look inward and does not seem to highlight such topics, which should be included in a business-oriented analysis of a work system.

 

**Transience and organizational flux**. WST/WSM provides a relatively lightweight approach that can be used even in reorganizations, staff reductions, transitions from older to newer product/service offerings, changing job roles, and increasing trends toward project work. It can be used to think and negotiate about all of those situations.

**Processes and activities**. Many types of work are automated and/or controlled to a greater extent than in the past. ERP, CRM, and BPM enable tighter work modularization, operational control, and near real time monitoring, sometimes leaving work system participants feeling as though Big Brother is watching, at least in the United States. WSM analysis would address those issues because the motivation and goodwill of work system participants strongly affect work system performance.

**Outsourcing**. WST/WSM views outsourcing as a configuration of work in which a work system's product/services are produced in a sociotechnical system that spans the original firm and the outsourcing vendor. It is not clear how traditional STS joint optimization would handle outsourcing situations.

**Workarounds and noncompliance**. An extension of WST called the "theory of workarounds" [9] serves as a reminder that work systems as documented may differ from work systems-in-practice even in the presence of monitoring systems.

**Participants**. WST/ WSM treats participants as integral parts of work systems, not just users of technology. WST/ WSM recognizes issues such as reduced social contact when working through computers and reduced value of existing knowledge and skills as technology and work arrangements change.

**New technologies**. Many sociotechnical systems apply computer and network capabilities that were almost unimaginable several decades ago. The extreme pace of technical change challenges the whole notion of joint optimization because the technologies bring new levels of capability whose impacts may be difficult to anticipate.

### 4.3 Benefit #3: Humanist Values Are More Likely to Be Recognized in IS Development

Use of WST/WSM could encourage attention to humanist values in IS development. This would occur through empowerment, awareness, and better communication and collaboration between all stakeholders in sociotechnical systems.

**Humanist values in IS development start with empowerment**. WST/WSM potentially empowers business professionals by providing an organized approach for thinking about work systems for their own purposes and for collaborating with others.

**Humanist values require recognizing the needs and skills of work system participants.** WST/WSM recognizes that work system performance depends on how well participants' skills, capabilities, interests, and ambitions fit with the characteristics of the rest of the work system.

**Humanist values require communication and collaboration**. An organized approach for thinking about sociotechnical systems potentially helps business professionals communicate effectively about how their roles in those systems affect them and their colleagues. Humanist values probably are less prominent in technology-focused analyses that outsiders create and bring to work system participants.

## 5 Recommendations and Conclusion

Involvement of managers and work system participants in designing sociotechnical systems should not assume that experts will do system-related thinking for them. This position paper's discussion of a work system lens for understanding sociotechnical systems implies a possible path for reconciling three types of concerns:

**System conceptualizations**. Facilitate the analysis of sociotechnical systems by organizing around WST/WSM instead of the joint optimization of partially overlapping social and technical systems.

**Business realities**. Recognize that IS development should focus on improving the performance of work systems guided by trade-offs between corporate and labor interests versus external customer interests. This involves much more than creating, testing, and implementing information systems and much more than joint optimization of social and technical systems.

**Achieving humanist values in IS development.** Empower work system participants and other stakeholders by providing concepts and methods that they can use themselves for their own purposes and can also use when collaborating with others.

There is no guarantee that a WST/WSM approach will succeed where traditional STS has faltered. Work system participants might not seize the opportunity to do more for themselves. At minimum, however, the use of a work system lens for STS brings the possibility of thinking about sociotechnical systems more effectively, reflecting business realities more completely, and achieving greater engagement and focus related to humanist values in IS development.

### References

1. Mumford, E.: The story of socio-technical design: reflections on its successes, failures, and potential, Information Systems Journal, 16, 317-342 (2006)
2. Sarker, S., Chatterjee, S., Xiao, X.: How "Sociotechnical" is our IS Research? An Assessment and Possible Ways Forward. Proceedings of ICIS 2013, Milan, Italy (2013).
3. Winter, S., Berente, N., Howison, J., Butler, B.: Beyond the Organizational 'Container': Conceptualizing 21st Century Sociotechnical Work. Information and Organization. 24(4), pp. 250-269 (2014).
4. Bostrom, R.P. and Heinen, J.S.: MIS Problems and Failures: A Socio-Technical Perspective. Part I: The Causes. MIS Quarterly. 1(3), pp. 17-32 (1977)
5. Alter, S.: The Work System Method: Connecting People, Processes, and IT for Business Results. Work System Press, Larkspur, USA (2006)
6. Alter, S.: Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future. Journal of the Association for Information Systems, 14(2), pp. 72-121 (2013)
7. Alter, S.: Work System Theory as a Platform: Response to a Research Perspective Article by Niederman and March, Journal of the Association for Information Systems, in press
8. Truex, D., Alter, S., and Long, C.: Systems Analysis for Everyone Else: Empowering Business Professionals through a Systems Analysis Method that Fits their Needs, Proceedings of ECIS 2010, Barcelona, (2010)
9. Alter, S.: Theory of Workarounds. Communications of the Association of Information Systems, 34(55), pp. 1041-1066 (2014)

 