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

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Organization

• Part 1: description of STS design
  – Are descriptions from leading journals reflected in STS practice?
  – Are basic STS concepts an obstacle to greater adoption?
• Part 2: could a work system approach help?
  – Single system with human participants
  – Assumption that typical business professionals should have a method that they can use themselves, with or without consultants and researchers
  – Would a work system approach address STS design issues?
“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. … All of these were to become the responsibility of the work group.”
Stages of ETHICS Methodology

Social System vs. Technical System

Figure 2. The Interacting Variable Classes Within a Work System
Joint optimization of the social system and technical system?

• Boundaries of the social system?
• Boundaries of the technical system?
• Meaning of joint optimization?
Is “task” social or technical?

- An automated business process is technical
- What about
  - a largely manual, communication-intensive business process?
  - a service process that requires customer participation?
  - coordination and articulation work?
  - undocumented steps?
  - improvisation and workarounds?
Is “structure” social or technical?

- “Structure-in-practice” is a reflection of tasks (which are viewed as technical)
- More than boxes in an organization chart
- Increasingly constrained and even controlled by capabilities and limitations of technologies such as ERP and networks.
Are “people” social or technical?

- Longstanding problems with poor communication and collaboration between business professionals and IT specialists
Is “technology” social or technical?

- Social aspects of smart phone technology and other collaboration/coordination technologies
- Social aspects of acceptance and use of new hardware/software configurations
- BYOD (bring your own device): social or technical?
Is “information” social or technical?

- Information stored in computerized databases may seem technical.
- Other information is highly social: commitments, conversations, organizational memory, culture, etc.
Are “product/services” social or technical?

- Many services are largely social.
- Some products seem largely technical
- Many product/services combine social and technical aspects
Joint optimization of social system and technical system?

• Social and technical systems overlap substantially.
• It is difficult to separate the social from the technical.
• Does the term joint optimization mean anything under those circumstances?
  — If so, what is the definition of joint optimization under those circumstances?
Questions for STS Practitioners

• Reality and understandability of the separation between the social system and technical system?
• Reality and understandability of joint optimization?
  – Different from “satisficing” (Simon)?
  – Different from negotiations and/or negotiated truce?
• Relevance in green field situations, major reorganizations with new participants?
• Relevance as “agile methods” are increasingly accepted?
• Relevance for implementations of enterprise software (ERP) that addresses corporate-level issues, not necessarily local issues?
• Ability to teach real STS design to typical business professionals?
### Examples of Work Systems
(from analyses by employed MBA students)

<table>
<thead>
<tr>
<th>Calculating rates for insurance renewals</th>
<th>Managing software development projects</th>
<th>Acquiring clients at a professional service firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving materials at a large warehouse</td>
<td>Approving real estate loan applications</td>
<td>Planning and dispatching trucking services</td>
</tr>
<tr>
<td>Performing pre-employment background checks</td>
<td>Performing financial planning for wealthy individuals</td>
<td>Scheduling and tracking health service appointments</td>
</tr>
<tr>
<td>Operating an engineering call center</td>
<td>Purchasing advertising services</td>
<td>Determining salary increases</td>
</tr>
<tr>
<td>Collecting and reporting sales data for a wholesaler</td>
<td>Planning for outages in key real time information systems</td>
<td>Invoicing for construction work</td>
</tr>
</tbody>
</table>
Work System Theory (WST)

- Basically: Look at situations as though the topic is a work system that needs to be improved.

- Definition of work system
- Work system framework
- Work system life cycle model
Definition of Work System

- A system in which human participants and/or machines perform processes and activities using information, technology, and other resources to produce products/services for internal or external customers.
- Sociotechnical by default, but may be totally automated.
- Typically uses IT but is not an IT system.
- More than just a business process.
Special Cases of Work System

- Information system
- Project
- Supply chain
- E-commerce
- Service system
- Totally automated work system
Work System Framework
(static view – assuming some on-going adaptation)
Work System Life Cycle Model
(iterations include planned and emergent change)
Work System Method

• Apply WST
  – Identify the smallest work system that presents an important problem or opportunity
  – Summarize and evaluate the “as is” work system
  – Analyze structure and performance as deeply as appropriate
  – Recommend a “to be” work system
  – Explain advantages of the improved version.

• Different versions for different purposes

• Include any aspects of Six Sigma or other tools that are useful in the situation.
# Work System Snapshot – a Basic Tool

## Customers
- Hiring manager
- Larger organization (which will have the applicant as a colleague)
- HR manager (who will analyze the nature of applications)

## Products & Services
- Applications (which may be used for subsequent analysis)
- Job offers
- Rejection letters
- Hiring of the applicant

## Major Activities and Processes
**Hiring manager** submits request for new hire within existing budget.
**Staffing coordinator** defines the parameters of the new position.
**Staffing coordinator** publicizes the position.
**Applicants** submit job applications.
**Staffing coordinator** selects shortlisted applicants.
**Hiring manager** identifies applicants to interview.
**Staffing coordinator** sets up interviews.

**Hiring manager and other interviewers** perform interviews.
**Hiring manager and other interviewers** provide feedback from the interviews.
**Hiring manager** makes hiring decisions.
**Staffing assistant** sends offer letters or rejections.
Successful **applicant** accepts or rejects job offer or negotiates further.

## Participants
- Hiring managers
- Staffing coordinator
- Applicants
- Staffing assistant
- Other employees who perform interviews

## Information
- Job requisition
- Job description
- Advertisements
- Job applications
- Cover letters
- Applicant resumes
- Short list of applicants
- Information and impressions from the interviews
- Job offers
- Rejection letters

## Technologies
- New HR portal that is being built
- Word processor
- Telephones
- Email
Relevant Extensions of WST

• Work system principles
• Work system design spaces
  – Various sets of typical design variables and design criteria
• Work system metamodel
  – Work system framework in more detail
• Theory of workarounds
  – Focusing on a key source of emergent change in the work system life cycle
• Operational view of service systems
  – Seeing work systems as service systems
<table>
<thead>
<tr>
<th>Customers</th>
<th>Products/Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1: Please the customers.</td>
<td>#2: Balance priorities of different customers.</td>
</tr>
</tbody>
</table>

### Processes and Activities

- #3: Match process flexibility with product variability
- #4: Perform the work efficiently.
- #5: Encourage appropriate use of judgment.
- #6: Control problems at their source.
- #7: Monitor the quality and timing of both inputs and outputs.
- #8: Boundaries between steps should facilitate control.
- #9: Match the work practices with the participants.

### Participants

- #10: Serve the participants.
- #11: Align participant incentives with system goals.
- #12: Operate with clear roles and responsibilities.

### Information

- #13: Provide information where it will affect action.
- #14: Protect information from inappropriate use.

### Technologies

- #15: Use cost/effective technology.
- #16: Minimize effort consumed by technology.

### Infrastructure

- #17: Take full advantage of infrastructure.

### Environment

- #18: Minimize unnecessary conflict with the external environment

### Strategies

- #19: Support the firm’s strategy

### Work System as a Whole

- #20: Maintain compatibility and coordination with other work systems.
- #21: Incorporate goals, measurement, evaluation, and feedback.
- #22: Minimize unnecessary risks.
- #23: Maintain balance between work system elements.
- #24: Maintain the ability to adapt, change, and grow.
Work System Design Spaces

- Work system principles
- Possibilities for change in a work system
- Work system characteristics
- Generic subsystem types within a work system
- Typical risks and obstacles
- Interactions with other work systems
- Locations for information and knowledge
- Design dimensions for products/services
### Possibilities for Change

<table>
<thead>
<tr>
<th>Possibilities for Change</th>
<th>Design space identifying possibilities for changing components, subsystems, and interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customers</strong></td>
<td><strong>Products/ Services</strong></td>
</tr>
<tr>
<td>Add or eliminate customer groups.</td>
<td>Change information content.</td>
</tr>
<tr>
<td>Change customer expectations.</td>
<td>Change physical content.</td>
</tr>
<tr>
<td>Change the nature of the customer relationship.</td>
<td>Change service content.</td>
</tr>
<tr>
<td>Change the customer experience.</td>
<td>Increase or decrease customization.</td>
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<tr>
<td></td>
<td>Change controllability or adaptability by the customer.</td>
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<tr>
<td></td>
<td>Change customer/participant relationships.</td>
</tr>
<tr>
<td></td>
<td>Provide different intangibles.</td>
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<tr>
<td></td>
<td>Change by-products.</td>
</tr>
<tr>
<td><strong>Processes and Activities</strong></td>
<td><strong>Information</strong></td>
</tr>
<tr>
<td>Change roles and division of labor.</td>
<td>Upgrade software and/or hardware to a newer version.</td>
</tr>
<tr>
<td>Improve processes and activities by adding, combining, or eliminating steps, changing sequences, or changing methods used within steps.</td>
<td>Incorporate a new type of technology.</td>
</tr>
<tr>
<td>Change business rules and policies</td>
<td>Reconfigure existing software and/or hardware.</td>
</tr>
<tr>
<td>Eliminate built-in obstacles and delays.</td>
<td>Make technology easier to use.</td>
</tr>
<tr>
<td>Add new functions not currently performed.</td>
<td>Improve maintenance of software and/or hardware.</td>
</tr>
<tr>
<td></td>
<td>Improve the processing of information (capture, transmission, retrieval, storage, manipulation, display).</td>
</tr>
<tr>
<td></td>
<td>Change practices related to physical things (creation, movement, storage, modification, usage, protection).</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td><strong>Technologies</strong></td>
</tr>
<tr>
<td>Change the participants.</td>
<td>Make better use of human infrastructure.</td>
</tr>
<tr>
<td>Provide training.</td>
<td>Make better use of information infrastructure.</td>
</tr>
<tr>
<td>Provide resources needed for doing work.</td>
<td>Make better use of technical infrastructure.</td>
</tr>
<tr>
<td>Change incentives.</td>
<td>Improve fit with organizational policies and procedures (related to confidentiality, privacy, working conditions, worker’s rights, use of company resources, etc.).</td>
</tr>
<tr>
<td>Change organizational structure.</td>
<td>Improve fit with organizational culture.</td>
</tr>
<tr>
<td>Change the social relations within the work system.</td>
<td>Respond to expectations and support from external stakeholders.</td>
</tr>
<tr>
<td>Change the degree of interdependence in doing work.</td>
<td>Improve fit with organizational politics.</td>
</tr>
<tr>
<td>Change the amount of pressure felt by participants.</td>
<td>Respond to competitive pressures.</td>
</tr>
<tr>
<td>Assure understanding of details of tasks and use of appropriate information and knowledge.</td>
<td>Improve conformance to regulatory requirements and industry standards.</td>
</tr>
<tr>
<td>Assure that participants understand the meaning and significance of their work.</td>
<td>Improve alignment with the organization’s strategy.</td>
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<tr>
<td></td>
<td>Change the work system’s overall strategy.</td>
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<td></td>
<td>Improve characteristics related to specific work system elements.</td>
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<td></td>
<td>Reduce imbalances between elements.</td>
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<td></td>
<td>Improve problematic relationships with other work systems.</td>
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<td></td>
<td>Conform to work system principles.</td>
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**Table 2. Design space identifying possibilities for changing components, subsystems, and interactions**
Work System Metamodel

(reinterprets and extends concepts in the work system framework)
Possible benefits of seeing sociotechnical systems through a work system lens

- Sociotechnical work systems will be more understandable.
- Systems analysis and design is more likely to reflect business realities
- Humanist values are more likely to be recognized in IS development
Sociotechnical work systems will be more understandable.

- More practical model
  - one system to be improved
  - instead of two overlapping systems to be optimized jointly
- Organized approach to business topics
  - Internal and external issues
- Possible use without consultants or researchers
Systems analysis and design is more likely to reflect business realities.

- Customers – at the top of the work system framework, may be participants
- Service systems, co-production of services
- Product/services are part of the picture
- Trans-organizational work systems
- Transience and organizational flux
- Processes and activities – partially automated or controlled by software
- Outsourcing
- Workarounds and noncompliance
- Participants – part of the work system
Humanist values are more likely to be recognized in IS development.

• “Empowerment” of anyone to think about work systems in an organized way
  – Not just consultants and IT specialists
• A step toward communication and collaboration – because anyone can use the approach