Chapter VIII
Research Directions on Incorporating Work System Method Ideas in Systems Analysis and Design

Ram B. Misra
Montclair State University, USA

Doncho Petkov
Eastern Connecticut State University, USA

Olga Petkova
Central Connecticut State University, USA

ABSTRACT

In this chapter, the authors analyze recent developments linking design science to systems analysis and design research and the growing area of the work system method proposed by Steven Alter. As a result, possible directions in a research agenda related to the incorporation of work system method ideas in systems analysis and design are provided. These follow the conceptual framework for IS research developed in 2004 by Hevner, March, Park and Ram.

INTRODUCTION

Due to the multi-disciplinary nature of the information systems (IS) field, there has been a long debate (e.g. see Lee, 2000, Orlikowski and Iacono, 2001, Hirschheim and Klein, 2003) about its core knowledge and scope. Hirschheim and Klein (2003) present a multidimensional analysis of the state of the IS discipline. Their chapter points at the richness of information systems develop-
Incorporating Work System Method Ideas in Systems Analysis and Design

ment as a field for exploration by IS researchers. Related issues are explored in Iivari, Hirschheim and Klein (2004). Lee (2000) suggested the idea of practicing design science as a potential direction for revival of the IS discipline. Hevner et al (2004) presented seminal directions for work in design science in IS research. These lead subsequently to an increased interest in research in Systems Analysis and Design (SA&D) (see Bajaj et al., 2005; Iivari et al., 2005; Harris et al., 2006). The importance of Systems Analysis and Design for any program of study in information systems is well summarized by Harris et al. (2006:242). Among the most important aspects of the relevance of SA&D they list the development of analytical and problem solving skills and the development and implementation of information systems (see Harris et al., 2006).

The growing interest in SA&D was evolving in parallel with a renewed interest in the applicability of systems thinking to Information Systems as a discipline (see Alter, 1999, Alter, 2004; Mora et al., 2007, Mora et al., 2008). Throughout these developments the ideas of Steven Alter on the work system method played persistently an important role (e.g. see Alter and Browne, 2005, Alter, 2006c). The work system method has emerged over the last decade as a theory for understanding the role of information systems in organizations and is gaining popularity among IS researchers (see Alter, 2006c; Korpela et al., 2004; Siau et al., 2004; Petkov and Petkova, 2008). In spite of that, we feel that there is a need for more work on the diffusion of work system method ideas in Systems Analysis and Design. This is the motivation for the work presented here.

We suggest here possible research directions for incorporating work system method related ideas in Systems Analysis and Design. These are an extension of the research by Alter and Browne (2005) and Alter (2006c) and they are in line with the recent revival of research in that area as advocated in Bajaj et al (2005). The chapter proceeds with an overview of the work system method (WSM) and related research, a review of recent work in systems analysis and design as well as design science, which are followed by the proposed directions for future work on applying WSM in SA&D followed by a conclusion.

THE WORK SYSTEM METHOD AND RELATED RESEARCH

The work system method is one of the two existing theoretical frameworks to support teaching of information systems at present. The other approach to introduce the IS field (used predominantly with MBA students) is the IS Interaction Model which focuses on the relationships between IS, their environment and the organization (see Silver et al. (1995). The Work System Method (Alter, 2006c), however, can be used both for IS teaching and research. That distinguishes it from the Interaction Model and makes it suitable for exploring its role in systems analysis. The work system method is an approach for understanding and analyzing systems in organizations including Information Systems (Alter, 2002). Petkov and Petkova (2008) published the results from a controlled experiment showing that it helped students in an introductory IS course to understand better an IS implementation problem.

The Work System Method

The work system method provides a rigorous but non-technical approach to any manager or business professional to visualize and analyze systems related problems and opportunities (Alter, 2006a). A very detailed justification for the work system method and how to apply it to define a work system, analyze it, formulate recommendations for improvement and guide its evolution is presented in Alter (2006c). The work system method (Alter, 2006c) has two major components: the work system framework, representing a static description of the work system and the work sys-
Incorporating Work System Method Ideas in Systems Analysis and Design

Incorporating Work System Method Ideas in Systems Analysis and Design

tem life cycle, focusing on the dynamics of a work system. Detailed definitions of the components of the work system framework are presented in Alter (2002a) and Alter (2006c). The interrelationships between the various elements of a work system are useful for generating an analysis of a specific business problem.

Both the **work system framework** (the static view of a work system) and the **work system life cycle** (the dynamic view how a current or proposed system evolves over time) have a complementary role (see Alter (2002a, 2006c). Table 1 defines several basic terms underlying the work system method, including the notion of work system. The latter does not necessarily include an information system and aims to describe how work is performed. Further elaboration on important definitions of related concepts is presented in Alter (2002a, 2006b).

The **work system framework** consists of 9 elements, 4 internal and 5 external. The four internal elements, considered part of the work system, include work items, processes to accomplish those work items, participants (direct and indirect both) to execute processes to perform those work items, technology needed to enable completion of processes and hence work items, and information or knowledge base needed. The five external elements, considered not part of the work system yet are important for its functioning, include strategy (both business and IS/IT), infrastructure needed to support the work system, environmental factors, product/services, and customers (internal, work system users and external, end customers).

### The Work System Method and IS Research

Information systems constitute a special case of work systems in which the business processes performed and the products and services produced are devoted to information (Alter, 2002a:95). Information systems exist to support other work systems and there could be some overlap with them. Various possible relationships between an IS and a work system are described in Alter (2002:96). Guidelines for analyzing work systems are presented in Alter (2002, 2006c). Recently Alter extended his approach to the area of service oriented organizations (see Alter, 2007b).

Alter (2006c) stresses that past dominance of single ideas like Total Quality Management and Business Process Reengineering are not sufficient to influence profoundly the IS field. The WSM is more broadly applicable than techniques “designed to specify detailed software requirements and is designed to be more prescriptive and

### Table 1. Some basic terms underlying the work system method (Adapted after Alter, 2002 and Petkov and Petkova, 2008)

<table>
<thead>
<tr>
<th>Basic Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work system</td>
<td>A view of work as occurring through a purposeful system</td>
</tr>
<tr>
<td>Work system framework</td>
<td>Model for organizing an initial understanding of how a particular work system operates and what it accomplishes.</td>
</tr>
<tr>
<td>Organization</td>
<td>Multiple work systems coordinated to accomplish goals that these work systems cannot accomplish individually</td>
</tr>
<tr>
<td>Static view</td>
<td>How a work system operates, based on a particular configuration</td>
</tr>
<tr>
<td>Dynamic view</td>
<td>How a work system’s configuration evolves over time</td>
</tr>
<tr>
<td>Work system life cycle</td>
<td>Process through which a specific work system is created and changes over time through planned and unplanned changes.</td>
</tr>
</tbody>
</table>
more powerful than domain-independent systems analysis methods such as soft system methodology” (Alter, 2002a). We may note that making comparisons between the work system method and soft systems methodology (see Checkland, 1999) requires a broader investigation of their philosophical assumptions and scope which is beyond the scope of this chapter.

The systemic nature of the work system method and its applicability to understanding business and IS problems is its most distinctive and important characteristics (Petkov and Petkova, 2008). Though the work system method has a relatively short history and a small but growing group of followers for now, the multifaceted scale of Alter’s work, bringing together systems ideas with methods for deeper understanding of work systems and IS, has strong appeal. Petkov et al. (2008) have concluded that the WSM could be used to change the attitudes of clients in managerial and operational user roles in combination with other relevant methods for the purpose of developing better understanding of organizational problems and to improve the communication between clients and software developers.

The practical value of the WSM emerges more strongly through the introduction in its most recent version in Alter (2006c) of three problem solving steps:

- **SP—Identify the system and problems:** Identify the work system that has the problems that launched the analysis. The system’s size and scope depend on the purpose of the analysis.
- **AP—Analyze the system and identify possibilities:** Understand current issues and find possibilities for improving the work system.
- **RJ—Recommend and justify changes:** Specify proposed changes and check the recommendation.

Within each step there are three levels of detail in which the issues are explored: at level one takes place a rough definition, at level two are explored a number of specific questions for each step providing additional information and perspectives on the problem situation while at level 3 are employed a number of diverse techniques and any other relevant data that can provide deeper understanding of the problem situation.

Alter’s proposal for work systems to replace the IT artifact as the focus of the IS discipline is an interesting innovative idea that has been considered to a degree already by others (see Alter, 2003; Jasperson et al., 2005; and Alter, 2006b). Alter (2002b) considers the four elements of an IT artifact that include information technology, the tasks, task structure, and task context within which it is used and shows “that the term IT artifact seems to encompass almost anything IT touches or affects directly, and is too unclear to serve as a basic concept for defining the IS field. IT artifact verges on being a synonym for the clearer term IT-reliant work system” (Alter, 2002b:496). Since the nature of the IT artifact is a central issue in IS research, it indirectly affects possible future work on the WSM and Systems Analysis and Design.

Most of the work related to the work system method has been related to the potential application of its concepts (e.g. see Siau et al., 2004, Casey and Brugha, 2005 and others). There have been very few attempts for a critical analysis of the WSM (see Korpela et al., 2004) or for linking it to other methods like the “work practice approach” (see Petersson, 2005).

The WSM was explored as a teaching tool only by a few authors discussed briefly in Alter (2006c). Ramiller (2005) is one of the few currently published sources on applying WSM ideas. It describes the use of the work system concept for understanding the notion of business processes in an undergraduate IS course. A few cases are discussed in Alter (2006a). An elaborate detailed
case study of WSM application can be found in Cox et al. (2002). Alter (2006c) provides evidence that work system ideas provide support for better understanding of business and systems problems when used with masters students who usually have a broader IT background (see Alter, 2006c). A detailed discussion of pitfalls in analyzing systems in organizations based on investigating 200 master’s projects is presented in Alter (2006b). Petkov and Petkova (2008) explored the role of the work system framework for improvement of student understanding of an IT related work system problem in an introductory business course on IS. They measured student learning through assessment of a team project and concluded that the Work System Framework has a positive impact on student understanding of business situation involving a complex IS problem. To the best of our knowledge no publication addresses currently all issues related to how the work system method can be applied in the teaching of systems analysis and design and that is an open area for research.

**RECENT IDEAS IN DESIGN SCIENCE AND SYSTEMS ANALYSIS AND DESIGN**

The renewal of interest in Systems Analysis and Design is related to a considerable degree to the publication of Hevner et al (2004) - a fundamental contribution to IS research that aimed to restore the balance between the two inseparable areas of IS research: behavioral research and design science research. Hevner et al (2004) raised a number of theoretical and practical aspects of stimulating research in design science, one of the two fundamental paradigms in IS research. They provide a conceptual model of IS research that integrates important considerations on relevance and rigor. At the same time they show the complementary role of design science and behavioral science approaches in IS research. They assert the role of design science within the dual understanding of design as a process and as an artifact. According to Hevner et al. (2004:79) behavioral science deals with the development and justification of theories that explain or predict the phenomena related to the identified business need while design science addresses research through the building and evaluation of artifacts that meet the business need. They define further that the knowledge base in their model provides the raw materials from and through which IS research is accomplished.

The aspects of design science research discussed by Hevner et al (2004) had a direct impact on the growing interest in Systems Analysis and Design teaching and research (see Bajaj et al., 2005 and Iivari et al., 2005). Alter and Browne (2005) were among the first to provide their contribution to the debate on the need for more research in SA&D. They note that existing definitions of SA&D like the one by Iivari et al. (2005) focus on the role of SA&D in the early stages of software development. Alter and Browne (2005) provide a much broader view of Systems Analysis and Design that captures better the diverse extent of the change in work practices by a particular activity requiring SA&D and the range of focus from technical to social aspects of the project. They define as a result six contexts of distinct SA&D situations:

- SA&D for SW/HW maintenance and bug fixes;
- SA&D for SW/HW upgrades involving work practices;
- SA&D for monitoring and patching work practices via process improvement and Six Sigma;
- SA&D for creation or major modification of IT-enabled work systems involving creation of new application software;
- A&D for creation or major modification of IT-enabled work systems involving configuration and installation of commercial application software;
Incorporating Work System Method Ideas in Systems Analysis and Design

- SA&D for organizational change and reengineering.

Alter and Browne (2005) focus also on two Information Systems development Performance Processes (following Iivari, Hirschheim and Klein, 2004): organizational alignment and requirements construction. Thus they focus on areas that are closely related to the core of Information Systems as a discipline, leaving out aspects of project management and software design as they are perceived to be closer to software engineering. As a result of the interweaving of the work system method with numerous other existing approaches to organizational alignment and requirements construction they provide a broad and systematic range of research issues in SA&D (see Alter and Browne, 2005).

Bajaj et al (2005) outline the characteristics of the gap between teaching and research in systems analysis and design and provide possible factors that contribute to that. Then they proceed to discuss how the conceptual model of IS research proposed by Hevner et al (2004) applies to Systems Analysis and Design. According to them:

**SA&D touches on several areas of the IS research framework..... In the knowledge base section, SA&D contributes by providing the models used to represent requirements and systems, and the methodologies used to develop systems drawing from several theories such as cognitive theories, frameworks...and ontologies ... In the IS Research Section, the framework identifies artifacts as a product of IS research, where artifacts can range from initial system requirements, to formal representations of systems, and to actual software. SA&D feeds the knowledge base via the creation of several IS artifacts. SA&D research can employ various research strategies such as laboratory experiments, field study, case study, action research, simulation, and analytical methods. SA&D also touches the Environment section given that SA&D research can be done in an organizational environment and incorporates the effects of personal or organizational characteristics. (Bajaj et al. 2005:481).**

We agree fully with the research directions on using the work System Method provided by Alter and Browne (2005). At the same time we feel that it is possible to formulate further directions for research on the Work System Method and SA&D by using as an organizing framework along the ideas of Hevner et al (2004) and Bajaj et al (2005) as shown in the next section.

**POSSIBLE FUTURE RESEARCH DIRECTIONS INCORPORATING WORK SYSTEM THEORY IN SYSTEMS ANALYSIS AND DESIGN**

Our suggestions are framed following the conceptual model for IS research and design science research according to Hevner et al (2004) and following some ideas in Bajaj et al. (2005).

**On SA&D and the WSM as Part of the Knowledge Base of IS Research**

Further work is needed on identification of the philosophical base of the Work System Method since currently very little is known about it apart from a certain link between it and pragmatism as suggested by Alter (2007) and Alter (2006c). Another possible direction for investigation is whether the WSM can embrace more fully systems concepts (see Bertalanffy, 1962). According to Alter (2007), evaluation of WSM in relation to general systems theory is all the more difficult because WSM was not developed as an application of general systems theory but as a set of ideas and tools that business professionals can use when trying to understand and analyze systems from a business viewpoint. Alter (2007) provides as an answer to this question a challenging reply in the
form of “weak maybe”. According to us there is a scope for further work on showing how the systems concepts that currently are incorporated in the WSM provide practical benefits to IS researchers along some of the directions suggested in Alter (2004) that distinguish the role of the WSM in the knowledge base of Information Systems as a discipline.

Alter (2006c) proposes Sysperanto as an ontology in applying the work system method. It is an open issue to investigate both the theoretical and practical value of Sysperanto compared to other ontologies suggested in the IS research literature like Wand and Weber (2002) and others.

The work system concept is used also in the socio-technical systems and in other strands of IS research. To the best of our knowledge there is a need for an analysis of any differences between the way how the notion of “work system” is used by Alter and those researchers working in other areas of IS or between notions like work system and “human activity system” (see Checkland, 1999) or purposeful systems as used in other systems thinking sources.

Another fundamental issue that deserves a broader discussion is whether the work system should replace the IT artifact as the focus of IS research as is argued by Alter (2002b) and Alter (2003). The finer details on how that notion is used require further discussion possibly as demonstrated by the debate in Jaspersen et al (2005) and Alter (2006a).

A recent direction in IS research is associated with service oriented systems (Alter, 2008) provides an interesting perspective on service system fundamentals and his ideas on how the work system framework, the work system snapshot and the service value chain framework can be applied to service system management can stimulate comparative analysis with other frameworks explaining service systems and practical implementation case studies on the relevance of the service value chain framework.

On the Interplay of SA&D and the WSM as Part of IS Research in the Conceptual Model for Design Science Research

The main artifacts that the work system method provides to IS research are the work system framework and the work system life cycle. We have mentioned the limited current research on the applicability of work system ideas in Information Systems Research and teaching like the cases described by Ramiller (2005) and Alter (2006b) or the field experiment discussed in Petkov and Petkova (2008). There is a need to provide evidence from further case studies, laboratory experiments and field experiments on the applicability of the WSM in SA&D. This requires changes in the way how SA&D is taught at undergraduate level, in postgraduate courses and in professional development courses. There is a need to investigate how the WSM is taught at universities and to disseminate the experience with it to a wider audience of IS educators through conference and journal papers along similar concerns about SA&D research in general as found in Bajaj et al. (2005).

The utility of the main artifacts of the WSM, mentioned above, to practicing information systems developers with respect to improving their understanding of the work system and the systems analysis tasks is an open issue. It is interesting to explore their potential in providing a balance between agility and discipline in IS development (see Boehm and Turner, 2004), along the suggested research directions in Bajaj et al. (2005).

On SA&D and the WSM and Their Role for Analyzing the IS Environment

Alter (2003; 2006c) points that the practical reasons for developing the work system ideas were associated with the needs to provide clients with a better way to express their understanding of
Incorporating Work System Method Ideas in Systems Analysis and Design

their work environment and IS requirements. Alter (2006b) has demonstrated the pitfalls associated with poor expression of those issues. Alter and Browne (2005) show how the WSM can be applied for investigating the IS environment which they justify with many published accounts of under-performing information systems. As is indicated in Iivari et al. (2005) and Bajaj et al (2005), the investigation of people, organizations and technologies are central to SA&D. Hence we may conclude that more analytical and case study work on the integration of the WSM in SA&D for the analysis of the environment of information systems development may contribute to higher rate of IS success.

CONCLUSION

We set out to identify possible research directions for incorporating work system method (see Alter, 2002a) in systems analysis and design. These research directions are further extensions to what has been previously proposed by Alter and Browne (2005) and Alter (2006c), and are along the lines recommended by Bajaj et al (2005). Our suggestions are framed following the conceptual model for IS research and design science research defined in Hevner et al (2004) and used in Bajaj et al. (2005). We identify the following possible areas of research:

• Identification of the philosophical base of the Work System Method.
• Investigation into whether the WSM can embrace more fully systems concepts.
• Investigate both the theoretical and practical value of Sysperanto compared to other ontologies suggested in the IS research literature.
• Analysis of any differences between the way how “work system” is used by Alter and those researchers working in other areas of IS or between notions like work system and “human activity system”.
• Developing a broader discussion on whether the work system should replace the IT artifact as the focus of IS research as argued by Alter (2002b), Alter (2003).
• Investigation into the applicability of WSM for service systems.
• Provide evidence from case studies, laboratory experiments and field experiments on the applicability of the WSM in SA&D.
• Establish the utility of the main artifacts of the WSM mentioned above to practicing information systems developers with respect to improving their understanding of the work system and the systems analysis tasks. Further issues relate to their potential in providing a balance between agility and discipline in IS development, along the suggested SA&D research directions in Bajaj et al. (2005).

We would like to underline that the Work System Method (Alter, 2006c) is an important theoretical development that emerged within the IS discipline. The evidence from the research related to it so far indicates its potential to contribute both to relevance and rigor in IS research. We hope that our suggestions may facilitate further theoretical and practical work on using the Work System Method in Systems Analysis and Design.

REFERENCES

Alter, S. (2002a). The work systems model and its role for understanding information systems and information systems research, Communications of the Association for Information Systems, 9, 90-104.

Alter, S. (2003). 18 reasons why IT-reliant work systems should replace ‘the IT artifact’ as the core subject matter of the IS field, Communications of the Association for Information Systems, 12(23), 365-394.


KEY TERMS AND DEFINITIONS

Systems Analysis and Design: The approach to the development of information systems that encompasses the first four phases of the systems development cycle (SDLC): Planning, Analysis, Design and Implementation (Harris et al., 2006)

The Work System Method: Provides a rigorous but non-technical approach to any manager or business professional to visualize and analyze systems related problems and opportunities (Alter, 2006a).