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18 REASONS WHY IT-RELIANT WORK SYSTEMS SHOULD REPLACE "THE IT ARTIFACT" AS THE CORE SUBJECT MATTER OF THE IS FIELD

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ABSTRACT

In an important *ISR* research commentary, Orlikowski and Iacono [2001] argue that the IS field does not deeply engage in its core subject matter, "the IT artifact." Although agreeing with their analysis and their conclusions concerning the unfortunate lack of engagement with the IT artifact, this article questions their premise that the IT artifact should be viewed as the core of the IS field. After defining the term "work system" and summarizing previously published frameworks for understanding a work system in operation and a work system life cycle, this article presents 18 reasons why IT-reliant work systems should replace "the IT artifact" as the core of the IS field. Taken in combination, the 18 reasons express a belief that today's IS field is inherently work system-centric, rather than IT-centric even though IT artifacts are present wherever the IS discipline is genuinely relevant. The specific reasons involve important topics including IS success, IS costs, IS risks, IS life cycles, methods for analyzing systems, communication with business professionals, organizing and codifying knowledge about systems in organizations, and maximizing the value of IS research.

Keywords: Information systems, IT artifact, IS field, work system, IS success, IS risks, system life cycle, systems analysis, system development, IS research, reference disciplines

I. INTRODUCTION

In a recent research commentary in *Information Systems Research*, Orlikowski and Iacono [2001] reviewed all of the articles published in *ISR* for the previous ten years and argued that "the field of information systems (IS), which is premised on the centrality of information technology in everyday life, has not deeply engaged in its core subject matter - the information technology (IT) artifact. … IS researchers tend to focus their theoretical attention elsewhere, for example, on the context within which some usually unspecified technology is seen to operate, on the discrete processing capabilities of the artifacts (as separate from how they operate in context), or on the dependent variable (that which the technology presumably changes as it is developed, implemented, and used). … As a consequence, IT artifacts in IS research tend to be

taken for granted or are presumed to be unproblematic." (pp. 121-122). Their review of *ISR* articles classified the articles in terms of different conceptualizations of IT, and they concluded with five premises that might be a starting point for theorizing about IT artifacts.[1]

Although not disputing their conclusions in any way, this article challenges Orlikowski and Iacono's initial assertion that the field of IS "is premised on the centrality of information technology." The fact that today's information systems use IT extensively does not necessarily require or imply that the field of IS should focus on IT or should be centered on IT artifacts *per se*. For example, the fact that transportation systems use vehicles does not necessarily imply that vehicles are the core subject matter for the field of transportation studies; similarly, voting procedures are not required to be the core subject matter of studies of democracy.

This article argues that IT-reliant work systems, rather than IT artifacts, should be the central focus of the IS field. This alternative focus certainly includes IT artifacts, but gives comparable weight to many other essential topics and issues that any IS practitioner, researcher, or student should recognize and understand in some depth.

We use the following definition:

> *IT-reliant work systems are work systems whose efficient and/or effective operation depends on the use of IT.*

Problems related to IT components of such systems typically degrade system performance and sometimes prevent system operation. IT-reliant work systems that are material systems include inventory replenishment in large retailers, express delivery of packages, and manufacturing of semiconductors. IT-reliant work systems that are basically information systems include approval of equipment loans, purchasing of airline tickets through web sites, and coordination and maintenance of global virtual teams [Alter, 2003a]. In both material and informational examples, the history, rationale, and operational details are often different in different instances of IT-reliant work systems with similar sounding missions. Therefore understanding any particular IT-reliant work system in depth requires looking at it specifically rather than talking about its category in general.

Many years ago IS professors were often viewed as the "computer people" in business schools. Today, as IT is pervasive and as IT literacy and even IT expertise are commonplace, there is little reason to strive to maintain that positioning. Recognizing IT-reliant work systems as the core of the IS field is less heretical than it might sound. In fact, it is consistent with current reality because the examples mentioned above represent the types of situations that receive much of the attention in today's IS field. If the future health and impact of the IS field hinges on its ability to address key issues about systems such as those in the examples, it must deal with work systems in their entirety. Accepting a smaller role and viewing the IT artifact as the core subject matter of the IS field will limit the potential contributions and significance of the IS field.

This article is organized in a simple manner. After summarizing basic ideas about work systems that are explained more fully in *CAIS* Volume 9, Article 6 published in September 2002 [Alter, 2002b], it identifies and briefly explains 18 reasons why IT-reliant work systems should replace the IT artifact as the core for the IS field. Throughout those explanations are many indirect challenges to Orlikowski and Iacono's claim that the IT artifact currently is the core subject matter of the field. Their article does an excellent job of identifying different views of IT in

[1] This article was submitted to *CAIS* in May, 2003 to present an alternative to Orlikowski and Iacono's belief that the IT artifact is the core subject matter of the IS field. Although questioning their view of the core of the field, this article does not dispute the main points of their article or their conclusions. In June, 2003, Benbasat and Zmud [2003] proposed in *MIS Quarterly* that the IS field should focus more closely on "the IT artifact and its immediate nomological net." In a separate article that is currently being edited for publication in *CAIS*, I will question Benbasat and Zmud's prescription for the future of the IS field and will suggest a different vision. Although there is some overlap between my two articles, it is impractical to combine them because they respond to different articles, focus on different themes, and cover many non-overlapping topics.

the existing IS literature. The goal here is to support the claim that treating IT-reliant work systems as the core will be beneficial to the future of the IS field.

As implied by its title ("18 Reasons Why …") this article is polemical in tone. To keep its length manageable and to keep the spotlight on the reasons it proposes, it references but does not fully explain points in Orlikowski and Iacono [2001] and a number of other articles, some of which I published or am currently working on. Given the breadth of topics mentioned, any attempt to explain representative opinions and research related to each reason would expand this article's length and diffuse its point. Also, it makes minimal attempts to identify or explain contrary viewpoints, such as beliefs that the core of the IS field is actually human-computer interaction, IT infrastructure, or the work of IT professionals.

Finally, note that a topic's proximity to the core of the field implies nothing about its significance in practice or research. For example, every medical service provider should know basic medical topics that constitute the core of that field, but when I have an unusual problem I want to be treated by a specialist who knows the latest research about that particular area regardless of whether it seems close to the core. In both medicine and IS, insignificant research near the core is less interesting and less important than significant research in a specialized area or at the periphery.

II. WORK SYSTEMS

The basis of this article is the concept of work system, a term that has been used by a number of socio-technical researchers and by some practitioners, but apparently in a less specific sense than it will be used here.[2] For our purposes, 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. Typical business organizations contain work systems that procure materials from suppliers, produce products, deliver products to customers, find customers, create financial reports, hire employees, coordinate work across departments, and perform many other functions. It is possible to view an entire organization, firm, or even an industry in work system terms, but that is not our intention here. For our purposes, organizations are best viewed as consisting of multiple work systems rather than as a single, large work system.

As is initially suggested in Alter [1999a] and extended and clarified in Alter [2002a; 2002b, 2002c], the work system method is being developed as a broadly applicable set of ideas that use the concept of work system as the focal point for understanding, analyzing, and improving systems in organizations, whether or not IT is involved. The premises underlying this method may be controversial in the IS community because they imply that the traditional jargon and concerns of IS practitioners and researchers address only part of the issues that should be

[2] The term work system appeared in two articles in the first volume 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] mentioned "attempts at comprehensive work systems design, including the social systems within which the work systems are embedded." Trist [1981] said that "primary work systems (the first of three levels of analysis, the others of which are "whole organization systems" and "macrosocial 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) ... "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 socio-technical insights cited by Pasmore [1985], such as "The work 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." Also, the term *high performance work system* appears occasionally in the popular business press and in some consulting circles with connotations related to high degrees of participation and self-management in organizations.

covered and may discourage focusing on other core issues related to successful projects and systems.

The work system method includes both a static view of a current (or proposed) system in operation and a dynamic view of how a system evolves over time through planned change and unplanned adaptations. The static view is based on the work system framework (Figure 1)[3], which identifies the basic elements for understanding and evaluating a work system. This framework is prescriptive enough to be useful in describing the system being studied, identifying

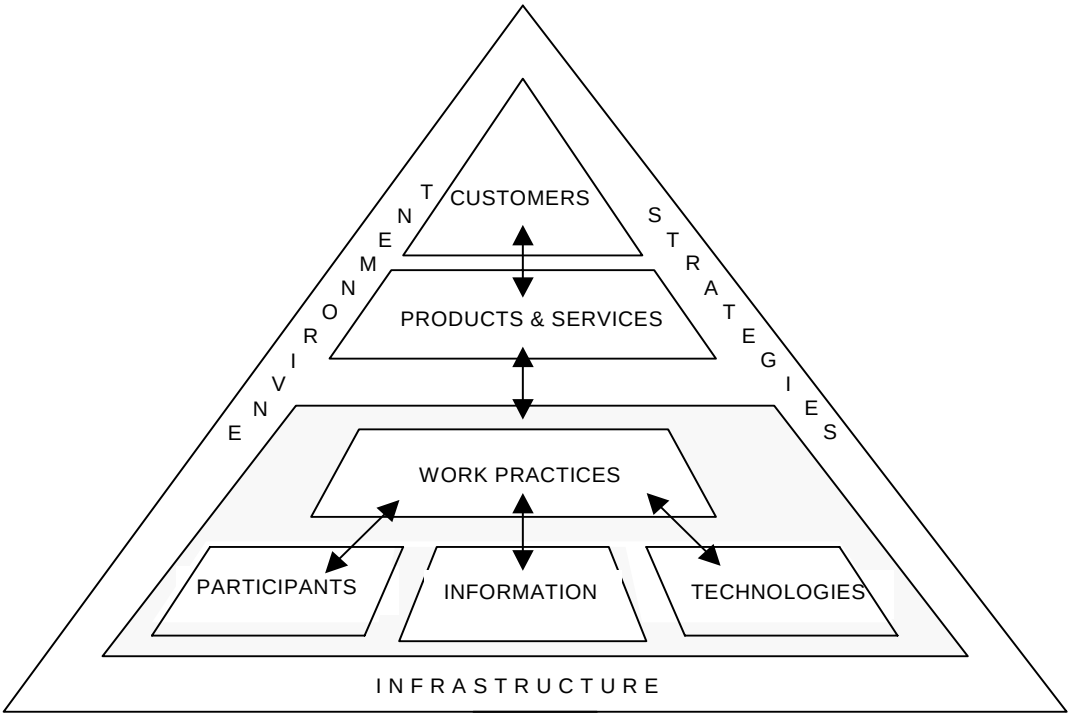


Figure 1. The Work System Framework (revised)

problems and opportunities, describing possible changes, and tracing the likely impacts as those changes propagate to other parts of the system. The dynamic view is based on the work system life cycle model (Figure 2), which shows how a work system may evolve through multiple iterations of four phases. The static and dynamic views are used together in a principle-based systems analysis method that treats the information system as part of the work system until a final step when it distinguishes between work system changes that do and do not involve the information system.

[3] The version of the work system framework in Figure 1 is updated from previous versions [Alter 2002a,2002b, and 2002c]. It renames the element "business process" using the more general term "work practices" to cover both business processes (prescribed sequences of interrelated steps) and other activities that occur within work systems but are not well described as business processes. Such activities include various types of communication, non-systemized decision making, sense making, improvisation, articulation work (e.g., Schmidt and Bannon [1992], Schmidt and Simone [2000]), workarounds, and exception handling.

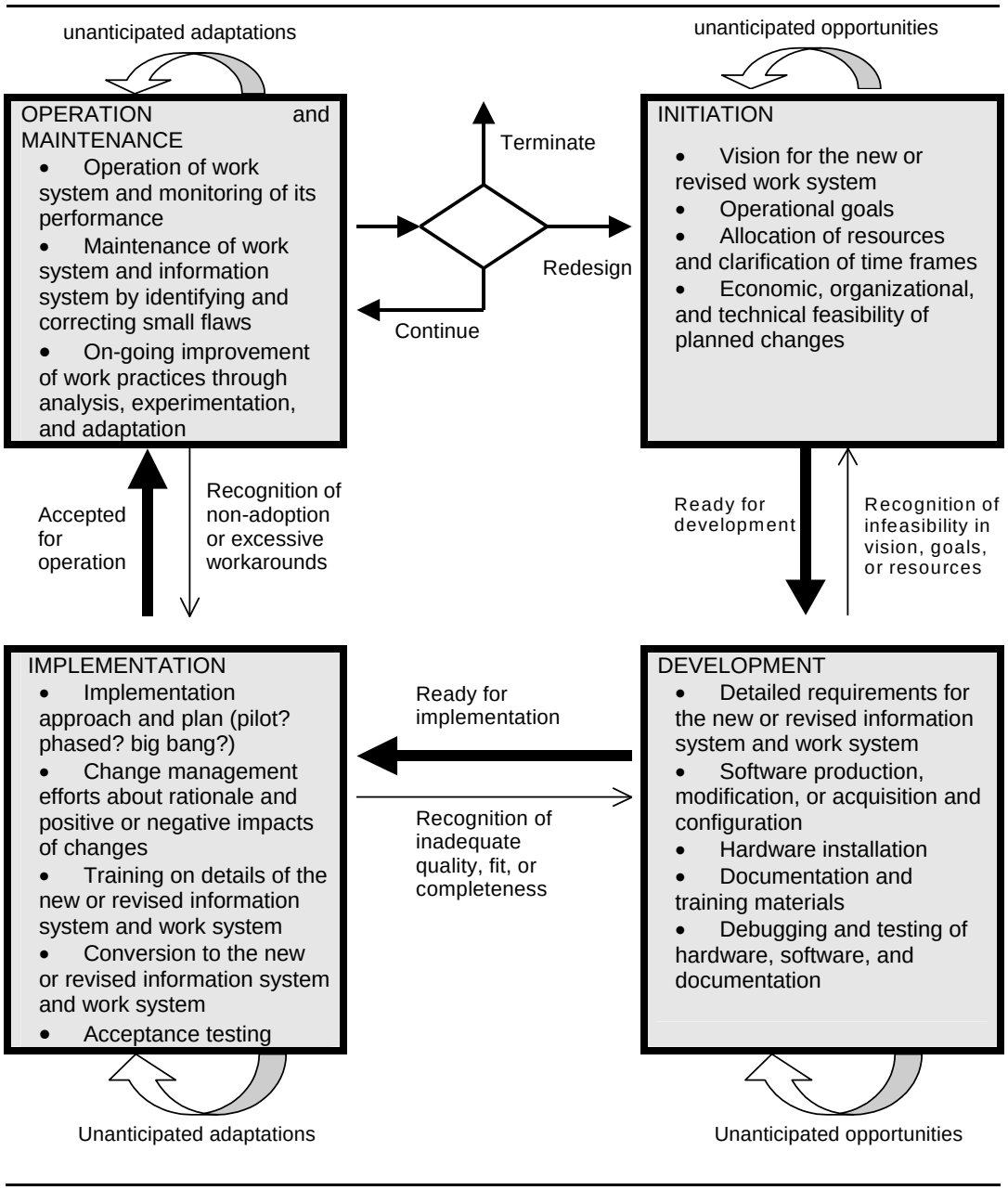


Figure 2. The Work System Life Cycle Model

The terms in the two figures are explained succinctly in Alter [2002b], which also argues that even a basic understanding of a work system covers the nine elements in Figure 1. Consequently, business and IT professionals discussing a real world situation should avoid focusing solely on information needs, computerized information, or IT. Similarly, they should avoid focusing solely on an idealized workflow or business process, thereby ignoring the deviations from prescribed methods that occur frequently because of errors, exceptions, and workarounds motivated by shortcomings of those methods or by personal incentives. Instead, they should view all elements of the work system in terms of what happens in reality.

Note that *work system* is a general case of systems operating within or across organizations. Therefore, most properties of work systems should be inherited by the special cases, which include information systems, projects, value chains, supply chains, and totally automated work systems.

The purpose of most information systems is to support one or more work systems. Although information systems and the work systems they support were often quite separable decades ago when most business computing was still card-based and batch-oriented, today many important information systems overlap significantly with the work systems they serve. In extreme cases such as highly automated manufacturing, the information system and work system overlap so much that the manufacturing is largely controlled by the information system. Turn off the information system and this type of manufacturing grinds to a halt.

III. REASONS WHY IT-RELIANT WORK SYSTEMS SHOULD REPLACE "THE IT ARTIFACT" AS THE CORE SUBJECT MATTER OF THE IS FIELD

The bulk of this article consists of brief commentaries on 18 reasons why IT-reliant work systems rather than "the IT artifact" should be viewed as the core subject matter of the IS field. The reasons are as follows:

Reason #1: Putting the "IT Artifact" in its Rightful Place from a Business Perspective

Reason #2: Incorporating the Most Relevant Parts of the Surrounding Context into the Analysis

Reason #3: Assuring that the Core Subject Matter of the IS Field Includes People

Reason #4: Developing Better Models of IS Success

Reason #5: Understanding IS Costs and the Productivity Paradox

Reason #6: Understanding IS-Related Risk

Reason #7: Improving the Analysis of Systems in Organizations

Reason #8: Understanding IS Development, Implementation, and Operation and Maintenance

Reason #9: Clarifying Responsibilities of IS and Business Professionals

Reason #10: Communicating with Business Professionals

Reason #11: Penetrating Techno-Hype and Reducing Techno-Centrism

Reason #12: Understanding Interactions between IS and Culture

Reason #13: Understanding Various Types of IS

Reason #14: Understanding Diffusion and Adoption of IT Innovations

Reason #15: Organizing and Codifying Concepts and Knowledge Related to IS

Reason #16: Making IS Research More Valuable

Reason #17: Strengthening Linkages between IS and Other Disciplines

Reason #18: Supporting the Research Agenda Proposed by Orlikowski and Iacono

These 18 reasons will be presented in turn. The commentary on the first three provides additional explanation about the general rationale for treating IT-reliant work systems as the core of the IS field. Most of the remaining commentaries describe how this view of the core of the field might contribute to understanding or researching important topics that are currently considered part of the field.

REASON #1: PUTTING THE "IT ARTIFACT" IN ITS RIGHTFUL PLACE FROM A BUSINESS PERSPECTIVE

Summary: *Treating IT-reliant work systems as the core of the IS field will help in establishing the proper priority involving work systems and their products (two things businesses really care about) and the technology that is used (something businesses care about far less).*

In a parenthetical comment in their first paragraph Orlikowski and Iacono [2001, p. 121] define IT artifacts as "those bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/ or software." They use five categories to classify conceptualizations of the IT artifact in *ISR* articles.

- In the nominal view the IT artifact is more or less absent;
- in the computational view it is an algorithm or model;
- in the tool view it is a tool for improving aspects of work;
- in the proxy view it is perceptions, diffusion, or capital;
- in the ensemble view (most similar to the work system view) it is represented in projects, embedded systems, or structure.

Their classification of articles supports an important commentary about the nature of past academic work in the IS field and about the preferences and beliefs of *ISR's* authors, reviewers, and editors. However, neither Orlikowski and Iacono's demonstration that *ISR* has not fully embraced the IT artifact nor their useful suggestions about directions for engaging more fully with the IT artifact imply that the IS field should organize itself around IT artifacts.

Although helpful in categorizing research articles published in *ISR*, Orlikowski and Iacono's classification scheme does not directly address the question of where the IT artifact belongs when one thinks about the IS field in normative terms. For example, treating IT as the headline (the computational view and possibly the tool view) is fine for people who develop or sell IT products, but IT surely isn't the headline when one speaks about systems in organizations, unless one assumes that IT includes most of what technology touches, including business processes, social arrangements, and aspects of the surrounding environment (the ensemble view).

To see the ramifications of making IT the headline when discussing a system in an organization, consider a brief case presented in *Harvard Business Review.* The case was called "The IT System that Couldn't Deliver" [Reimus, 1997]. The story concerned an attempt to provide laptop-based sales tools to insurance salespeople in the belief that these tools would allow more effective ways to gather client information and present alternatives to their clients. Unfortunately the firm's CIO had taken on the project three years earlier and the implementation was proceeding slowly. In the interim, other firms started similar initiatives, and the desired market advantage did not materialize. The case said little about the computerized aspects of the new sales support system, and focused on issues related to responsibility for various aspects of the strategy, the project, and delayed implementation in the organization.

Whether intentionally or not, the title of the case illustrates the danger of failing to put the IT artifact in its rightful place from a business perspective. The case was called "The IT System that Couldn't Deliver," but the real issue was that three years of work had not yet changed the way the company's sales force sold insurance. In this realistic situation, a large company's CEO and CFO seemed not to grasp the nature of the system that was being built even though they had some idea about the type of computer functionality that was being produced. They acted as though they had commissioned an IT system, a stance that did not generate the necessary urgency and involvement by the sales force. The case did not fully explain details of the design and development efforts, but the real issues were not so much about building an IT system as about creating and implementing a new way to sell insurance. Saying that this case was about an IT system that not deliver makes no more sense than saying that a mistake by an order entry clerk is a computer error or that the failure of dot.coms with illogical business models is a failure of the Internet.

The title of the case used the term "IT system," but "The Information System that Couldn't Deliver" would have been an equally misleading title. Building the information system was

important, but it would have little significance unless it became an integral part of a work system of selling insurance through work practices involving much more than steps involving the information system. If the CEO and CFO had viewed their goal as building a new work system for selling insurance, they might not have acted as though the IT system was a "magic bullet."[4]

REASON #2: INCORPORATING THE MOST RELEVANT PARTS OF THE SURROUNDING CONTEXT INTO THE ANALYSIS

Summary: Treating IT-reliant work systems as the core of the IS field will make work systems into the unit of analysis, thereby making the analysis more valuable by incorporating the most relevant part of the information system's surrounding context into the system being analyzed.

The analysis of systems in organizations is perpetually complicated by the relationships between systems, most of which can be viewed as subsystems of other systems. For example, Silver et al [1995] cite Ackoff [1993] as stating that "it is not possible to understand a system by *analyzing* it alone - that is, by simply decomposing it into its constituent parts. One must first *synthesize* it - determine its function in the supersystem, the next higher level system of which it is a part. In the case of an information system, this supersystem is the organizational (or inter-organizational) system to which it belongs." Similarly, Checkland notes, "whenever one system serves or supports another, it is a very basic principle of systems thinking that the necessary features of the system which serves can be worked out only on the basis of a *prior* account of the system served." (Checkland [1997], cited in Rose and Meldrum [1999]).

Figure 3 shows how the idea of work system provides an organized way to deal with this issue even within an IT-centric view.[5] Instead of saying that the information system is the system under consideration and the organization is its supersystem, the work system approach for thinking about systems in organizations says that the analysis should start with a particular work system, which should be analyzed in the context of its environment (including relevant aspects of the organization in which the work system operates). The information systems supporting that work system often overlap substantially with the work system. Analyzing the work system without separating out the information system provides a balanced approach for understanding how the work system operates and how it might be improved through changes that might or might not involve IT.

One might argue for expanding the scope further by analyzing the larger system that the work system serves. The question of where to set the boundary when describing or analyzing a system is a common quandary. If the system's scope is too broad, the system will be too difficult to understand or analyze within the time available. If it is too narrow, important issues and phenomena will fall outside of the analysis. The practical compromise is to define the system as the smallest system that exhibits or contains whatever problems or opportunities motivated the analysis. As regards information systems versus work systems, setting the boundary at the work system assures that more of the relevant business concerns are included and that the results of the analysis are more likely to include necessary changes that may not involve software or hardware.

[4] This type of "magic bullet" was described by Markus and Benjamin [1997]

[5] Figure 3 ignores the possibility that a given information system that plays an infrastructure role might support multiple work systems.

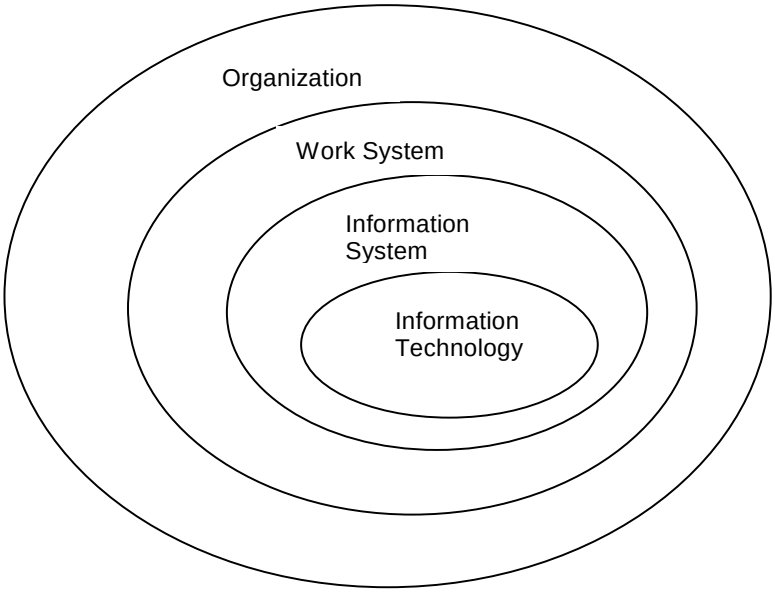


Figure 3. IT-Centric View of an Information System that Supports A Work System within an Organization

REASON #3: ASSURING THAT THE CORE SUBJECT MATTER OF THE IS FIELD INCLUDES PEOPLE

Summary: Treating IT-reliant work systems as the core of the IS field will insure that both people and technology are present in the analysis, and will also avoid the commonly mentioned but unnecessary socio-technical split between the social system and the technical system.

If IT artifacts are the core subject matter of the IS field, and if one adopts Orlikowski and Iacono's definition of IT artifacts ("those bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/ or software"), it is not clear whether people really are part of the core of the field. Consider, for example, future research concerning a data warehouse. Viewing the IT artifact as the core of the IS field would encourage emphasizing the hardware and software used to store and retrieve information and de-emphasizing aspects of its operation related to the specific people or work systems, such as the analysts that use it for data analysis. In contrast, viewing IT-reliant work systems as the core would encourage focusing on the data warehouse as a work system in which people apply data warehousing technology to organize, consolidate, and analyze information. In relation to Orlikowski and Iacono's five categories for *ISR* articles, this view of data warehousing most closely resembles the ensemble view adopted by only 12.5% of the *ISR* articles.

Viewing the core as a work system understood in terms of the nine elements in Figure 1 is consistent with the socio-technical premise that systems in organizations contain both social and technical components. The socio-technical literature often suggests considering objectives and alternatives separately for the social system and the technical system and then selecting the set of alternatives that best fits both sets of needs [Mumford and Weir, 1997, pp. 26-43; Hirschheim and Klein, 1994, pp.106-107]. Possibly motivated by the same tradition, a recent special issue of *Information Systems Frontiers* was called "Co-Design of Business and IT Systems." [Liu et al, 2002].

Although it is desirable to consider both the social and the technical, there is no obvious reason why the social system and technical system should be analyzed separately. One might

even speculate that the inefficiency of unnecessarily separating processes that analyze and find alternatives for both the social system and the technical system is one of the reasons why "there is little evidence that socio-technical methods as such have been widely used [even though] there is some evidence that socio-technical precepts have become part of the language related to the management of change" [Land, 2000]. Perhaps ideological struggles between pro-humanist and pro-managerialist camps somehow became an obstacle to greater acceptance of formal methods presented under a socio-technical banner. Consider Mumford's comment about the past and future of socio-technical methods:

> *"Socio-technical design is an enigma. It has offered so much and produced so little and we need to know why. When it was first developed after the second world war it was seen by its creators as a means for optimizing the intelligence and skills of human beings and associating these with new technologies which would revolutionise the way we live and work. This did happen for a while in the 1970's when many industries tried to implement socio-technical methods of working. But initiatives gradually faded away so that today, when we are nearing the millennium, we still have many people working on jobs which are routine, tightly controlled and provide few opportunities for personal development."* [Mumford, 2000]

A possible interpretation of Mumford and Land's comments is that general awareness of socio-technical concerns is now commonplace, but that the ideological goals of the original socio-technical movement were not realized.[6]

The proposal to view IT-reliant work systems as the core of the IS field is meant to include both social and technical issues while trying to remain neutral in regard to ideological struggles between pro-humanist and pro-managerialist camps within IS researchers. Everyone involved in the analysis and design of systems -- the managers, the IT professionals, and the work system participants -- should have the possibility of using effective, organized methods that consider social and technical issues as part of their participation. Treating the core of the IS field as IT-reliant work systems automatically includes people as part of the systems being studied but does not imply that pro-humanist or pro-managerialist choices must be made.

REASON #4: DEVELOPING BETTER MODELS OF IS SUCCESS

> *Summary: Treating IT-reliant work systems as the core of the IS field will help in developing and applying more meaningful models of IS success*.

Figure 4 [Alter, 2002b] illustrates part of the longstanding difficulty the IS field encountered in relation to the concept of IS success. It is relatively easy to evaluate whether precisely formulated projects met their goals in terms of budget, schedule, and functionality, but it is more difficult to say whether many operational information systems are truly successful. As illustrated in Figure 4, the increasing degree of integration between information systems and the work systems they

[6] Commenting on an earlier draft of this section, Land [2003] said "The socio-technical attempt to consider a system as having a technical component and a human component to be separately considered stems I suspect from the difficulty of identifying human objectives such as those leading to job satisfaction in the context of the objectives of the organization. This harks back to the time when scientific management was thought to be the way to achieve improved organizational performance. The separation enabled socio-technical organizational designers to analyse human behaviour in the context of human needs. Do we still need such a separation? The socio-technical ideology does not require it. But does the separation facilitate or inhibit the design of the work system?" Land also said, "The question of choosing between a humanist or managerialist approach is perhaps more important than you make it appear. Business process design is driven by certain imperatives. The designer has to make personal choices between accepting what he or she perceives to be a managerial imperative such as 'downsizing' or 'outsourcing' and humanistic imperatives which would look for alternative solutions to the business problem. There are many situations where no clash occurs, but equally there are many where there is a real problem of conflicting values."

support makes the entire topic of evaluating the information system and its impact on work system success problematic. Important aspects of the work system cannot operate without the information system, but the work system may also include decision-making, communication, negotiations, physical activities, and many other activities that are untouched by the information system even if they may be influenced by it indirectly.

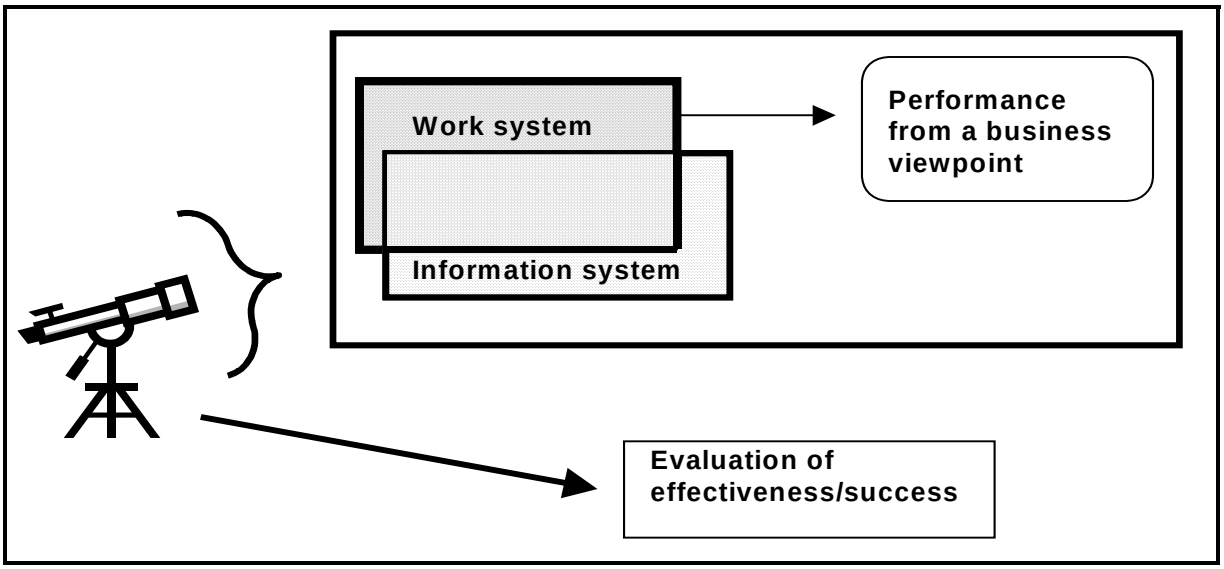


Figure 4. Cause of Increasing Difficulty in Assessing Information System Success

Success measures that focus solely on the information system are designed to ignore aspects of real world situations that are relevant and often easily understood. The measurable performance of the work system includes both internal performance (such as productivity, consistency, activity rate, and cycle time of the work) and external performance (such as product cost, quality, and reliability perceived by the customer). From a business viewpoint, the performance of the work system is more important than the performance of the information system because it is more directly linked to the organization's success. From this viewpoint, the IS field's traditional concern with IS success emphasizes what is less important. Given the overlap between information systems and work systems they support, it is difficult to evaluate the success of an information system in isolation and the entire system effort may be deemed unsuccessful if the work system disappoints or fails for reasons unrelated to the information system. [7]

Information systems and the work systems they support are increasingly like Siamese twins that are inextricably connected. Remove the information system and the work system can't operate. Ignore the work system and the information system is meaningless. Conceptualizing information system success without looking at the work system that is being supported is increasingly like evaluating one twin but consciously ignoring the other. [Alter, 1999b] Despite the IS field's traditional concerns about IS effectiveness, focusing entirely on one twin and excluding the other from careful consideration seems self-defeating for IS practitioners or researchers desiring genuine impact in today's world. For researchers, this issue involves the boundaries for defining and analyzing IS effectiveness. Looking at just the information system (or just the IT

[7] For example, consider a well designed planning information system that worked effectively for years. A new CEO comes on the scene with a new agenda and changes corporate planning from a bottom-up work system to a top-down work system. The previously successful information system still processes the same information, but submitting and using its information results in little impact on important decisions. From a business viewpoint, evaluating this information system separately from the work system is not useful.

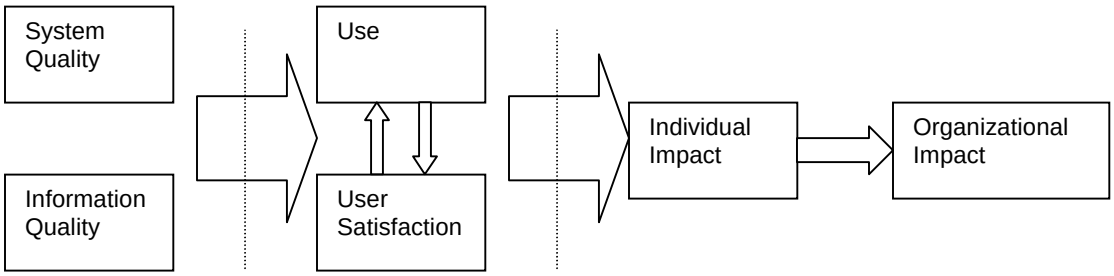
artifact) without looking at the work system may be cleaner and may build more directly on past IS research, but this is not the direction that maximizes the potential value of future research.

Implications for IS Success Models

As noted by DeLone and McLean [2002], the Delone and McLean IS Success Model published ten years earlier [DeLone and McLean, 1992] "has become a standard for the specification and justification of the measurement of the dependent variable in information system research." That model was developed to classify IS effectiveness measures appearing in seven journals during 1981-1987. Figure 5 shows the original form of the model, which was expressed as follows:

> *"SYSTEM QUALITY and INFORMATION QUALITY singularly and jointly affect both USE and USER SATISFACTION. Additionally, the amount of USE can affect the degree of USER SATISFACTION - positively or negatively - as well as the reverse being true. USE and USER SATISFACTION are direct antecedents of INDIVIDUAL IMPACT; and lastly, this IMPACT on individual performance should eventually have some ORGANIZATIONAL IMPACT." (p. 83).*

Subsequently their model was cited extensively and was used in many other ways. For example with the addition of a box for service quality, it is currently used to organize the IS Effectiveness home page in www.isworld.org. Ten years after it first appeared, McLean and DeLone (2002) reviewed 150 references to the model, discussed several suggested improvements by other authors, and then proposed a revised version based on current knowledge about IS success. The proposed revision adds a box for "service quality," converts "use" to "use (intention to use)," and replaces "individual impact" and "organizational impact" with "net benefits."



Source: [DeLone and McLean, 1992, p. 87]

Figure 5. The Original DeLone and McLean IS Success Model

Although the original model proved useful in supporting discussions of IS effectiveness, looking at it through a work system lens and paying attention to the increasing degree of integration between information systems and the work systems they support immediately leads to a number of questions about what the boxes mean (other than as categories for research) and whether the model itself is meaningful for looking at success in specific situations. Consider the specific terms that it uses:

> System quality: Does this term refer to information system quality or work system quality? Is it possible to have a high quality information system and a low quality work system, especially if the information system and work system overlap substantially?
>
> Information quality: Is quality measured in terms of the demands of the work system or in terms of the inherent quality of the information regardless of whether the information is needed or used in the work system?

Use: Is use assumed to be voluntary use within unstructured or semi-structured work practices, or is it mandatory use within a highly structured business process that requires all participants to work in a similar manner?

User satisfaction: Is user satisfaction typically dominated by issues related to the information system or issues related to the work system, especially if the information system and work system overlap substantially?

Individual impact: Is individual impact typically dominated by issues related to the information system or issues related to the work system (such as the demands of the work practices and the surrounding context)? Whether or not the IS field focuses on information systems, there is no reason to consciously ignore impacts from the work system itself, especially if the work system causes more important individual impacts than the information system.

Organizational impact: Many information systems are integral parts of work systems. Is it really meaningful to talk about the "organizational impact" of an integral part of a work system? Wouldn't this be like talking about the impact of your brain on your body? Isn't it more meaningful to talk about the organizational impact of the work system itself?

These issues concerning the meaning of the terms in a commonly used success model stem from an underlying assumption that success is about perception, use, and effectiveness of an IT artifact. Moving toward a work system view shifts the focus for understanding success. Some support exists for that shift. In an ICIS 2002 panel on IS success Seddon [2002] argued that IS success is best understood using a 7-factor model based on questions suggested by Cameron and Whetton [1983] for evaluating organizational performance. The 7 factors are:

- the system,
- the stakeholders,
- the purpose of the evaluation,
- the measures,
- the referent for comparison (e.g., goals, benchmarks),
- the time period,
- the informant.

In his comments, Seddon referred to Figure 4 as previously published [Alter, 2002b] and noted that the relevant system for evaluating success was the work system rather than just the information system.

REASON #5: UNDERSTANDING IS COSTS AND THE PRODUCTIVITY PARADOX

Summary: Treating IT-reliant work systems as the core of the IS field will help in developing and applying more meaningful models of IS costs and in understanding the root causes of the productivity paradox.

The costs associated with information systems and information system projects often involve activities and factors that cannot be attributed to the information system per se. This assertion is represented in the work system life cycle in Figure 2. The implementation phase within each iteration of the life cycle may take longer and cost more than the development phase that often receives more attention. Some aspects of the implementation phase are directly related to the information system changes, but other aspects of implementation are about issues and work practices not directly touched by the information system.

For example, in an interview in *CIO Insight* [Kindery, 2001], Erik Brynjolfsson describes the "disproportionately large amount of organizational capital associated with technology investments." … "Among the companies [he and colleagues] studied, there were on average $10 of organizational capital associated with every $1 of technology capital." Although this 10 to 1 ratio does not reveal how much of the organizational capital was directly related to information

systems, at least some of it was surely related to work practice and organizational changes not solely related to information system issues. Similarly, based on data from Forrester Research plus his own calculations, Brynjolfsson estimated that typical start-up costs for an ERP suite were $0.8 million for hardware, $3.2 million for software, and $16.5 million for implementation and deployment. The ratio of total start-up costs to IT hardware cost was 26:1. And even that did not include "management time selecting, designing, and managing implementation, including the modification of business processes, nor did it include staff time informally learning to use the [ERP] system or modifying business processes to work with the [ERP] system."

Brynjolffson's research is directly related to the productivity paradox, the frequently debated degree of correlation between IT investments and productivity. If the productivity paradox is measured based on hardware expenditures, if these are less than 10% of the organizational expenditures required to improve work systems through changes involving better technology, and if the same variability in effectiveness occurs in the organizational expenditures as occurs in the hardware expenditures, it is not surprising that productivity effects related to differences in hardware expenditures will be washed out by productivity variability related to the other expenditures. Describing wide dispersion in a scatterplot of IT investment versus productivity in a sample of 1,167 companies, Brynjolfsson [2003] says,

> *"it's easy to see that the overall relationship between IT and productivity is positive. However, it's also evident that there's tremendous variation in performance among companies."*

REASON #6: UNDERSTANDING IS-RELATED RISK

> *Summary: Treating IT-reliant work systems as the core of the IS field will help in understanding IS-related risks since many of the most common risk factors are risk factors for work systems in general and since risk management activities must occur at both the work system and information system levels.*

IS risk has been discussed for at least 30 years. Hundreds of articles mention system-related success factors or risk factors and hundreds of risks and risk factors related to information systems and projects were identified. Simply listing such factors and justifying a particular list based on a focus group, a case study, or personal experience is increasingly unsatisfying when there is no underlying theory or structure that explains how the various factors are related to one another, why a particular list should be viewed as reasonably complete, or how any particular list of risk factors compares to the many other lists that may refer to different situations.

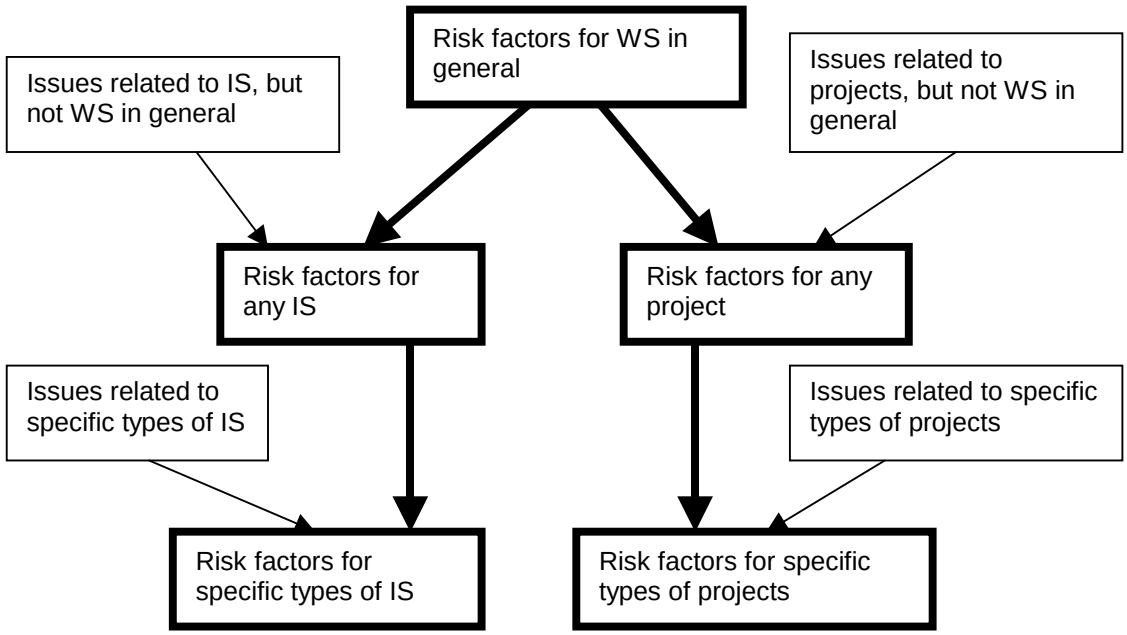
On-going research with a co-author generated a number of results that show why treating IT-reliant work systems as the core of the IS field may help in understanding IS-related risks. A review of over 40 articles from the risk-related IS literature found 228 distinct risk factors, many of which were mentioned by more than one article. We used the nine elements of the work system framework (Figure 1) to classify the risk factors and found that 52 concerned work practices, 49 concerned participants, 33 concerned customers, and the others were divided among the other six elements. Many of the mostly commonly mentioned risk factors (such as inadequate management support, knowledge, experience, and resources) apply to any work system and are not uniquely related to either information systems or projects.

To make sense of IS-related risks in the literature, we hypothesized that most of the risk factors (and success factors) that apply to work systems in general are inherited by special cases such as information systems and projects.[8] Figure 6 illustrates the nature of the inheritance relationships.[9] Various risk factors applied at any of 8 different levels including work systems in

[8] An information system is a work system whose work practices are devoted to processing information. Similarly, a project is a work system designed to produce a particular result and then go out of existence.

[9] An earlier version of the figure in Alter [2002a, 2002b] was stated in terms of success factors, but the form of the relationships is the same for risk factors.

general, information systems in general, projects in general, information system projects, types of information system projects, software, and software projects. In many cases, a risk study looking at a particular type of situation, such as IS projects, generated risk factors that seem equally valid (based on common sense and business experience) both for more general cases (such as projects in general) and for more specific cases (such as ERP projects). We created a 228 X 8 table listing each risk factor and identifying the various levels at which it seems to apply (i.e. not only the level at which the data was gathered for the original risk study). Inspection of that table leads us to conclude that a hierarchy of inheritance can be used for classifying and making sense of IS-related risks. The inheritance of work system properties by special cases such as IS and projects implies that the jumble of risk components and risk factors in the risk-related literature can be sorted out and that future research about IS risk can start from an organized set of risk factors. This perspective on IS risk flows directly from a work system view of the IS field. Viewing IT artifacts as the core of the IS field would lead to a much more restricted view of IS risk.



WS=work system

Figure 6: Hypothesized Inheritance of Risk Factors for Work Systems and Special Cases such as Information Systems and Projects

REASON #7: IMPROVING THE ANALYSIS OF SYSTEMS IN ORGANIZATIONS

> *Summary: Treating IT-reliant work systems as the core of the IS field will improve the analysis of systems in organizations by generating a better balance between the amount of effort devoted to what computers do and the amount of effort devoted to what people do.*

Most systems analysis and design methods taught in systems analysis courses do look at the work system that is being improved (whether or not they call it a work system), but are basically about developing or improving information systems. From a business viewpoint, however, the primary goal is not producing a better information system. Rather, it is producing a better work system by identifying and implementing improvements in the information system and in aspects of the work system that may not be touched directly by the information system.

Treating IT-reliant work systems as the core of the IS field should lead to development of better systems analysis methods that include the parts of the situation that are not fundamentally about the information system. An attempt in this direction is the work system method described in Alter [2002a; 2002b, 2002c]. This systems analysis approach was originally developed to help business professionals think about specific systems with or without the help of IT professionals. Instead of starting with the information system, the work system method starts by identifying a problem or opportunity along with the smallest work system to which that problem or opportunity applies. The analysis process compares the current reality to general principles that apply to any work system, such as please the customer, do the work efficiently, and serve the participants. These comparisons lead to the identification of other problems and opportunities, help in identifying possible improvements, and help in deciding whether changes that are potentially beneficial in one part of the system might cause problems elsewhere in the system. The recommendation separately describes the work system changes that depend on information system changes and the work system changes that are unrelated to the information system. This method is designed to help business and IT professionals place primary emphasis on what the business cares about more, the work system and its performance, and secondary emphasis on the information system that will support the work system changes. Various iterations of this method were used by over 200 teams of employed evening MBAs and EMBAs writing group papers assigned as a major component of information system courses for generalists. These papers analyzed systems in finance, sales, production, customer service, and HR departments of a cross-section of service and manufacturing firms in Northern California. Personal comments from students and student diaries collected at the end of each semester indicate that many of these evening students find the approach valuable in their work settings.

Efforts to develop systems analysis methods that focus on work system issues should also help in appreciating the emphasis and limitations of most current systems analysis and design methods. For example, comparison with the work system method (or something like it) may make it apparent that many widely accepted systems analysis methods focus too much on documentation of the database and the idealized business process, and too little on incentives, knowledge issues, difficulties in articulation across subtasks, and work system issues not related to the information system. Furthermore, comparison with the work system method may make it more apparent that most current methods are designed for use by IT professionals who need to specify all of the details required to create or modify software, but cannot be used effectively by business professionals who need to understand work systems and information systems at a less detailed level, with more attention to how work is accomplished and less attention to IT artifacts.

REASON #8: UNDERSTANDING IS DEVELOPMENT, IMPLEMENTATION, AND OPERATION AND MAINTENANCE

> *Summary: Treating IT-reliant work systems as the core of the IS field will help in understanding IS development, implementation, and operation and maintenance because it will become more apparent that victory is not about producing software on time and to specifications, but rather, about improving work systems that will continue to change over time*.

Project and life cycle models that focus on IT artifacts tend to ignore or de-emphasize many issues that are significant to businesses trying to improve the performance of their work systems. The work system life cycle model in Figure 2 was designed to encompass many of the topics covered in typical project models while also representing the iterative nature of work system life cycles. It summarizes how a work system's form evolves through iterations combining planned and unplanned change. In planned change, human, monetary, and technical resources are allocated to a visible project (with initiation, development, and implementation phases) whose goal is to change the system's form. In unplanned change, small adaptations lead to further adaptations usually accomplished without major projects or major allocation of resources.

The names of the four phases were chosen as a common denominator for custom development, use of application packages, prototyping, end user computing, and other ways to build information systems. Alter [2001b] showed how an earlier version of the model

encompassed over a dozen life cycle models in the IS literature. The revised version shown in Figure 2 adds explicit recognition of unanticipated opportunities and unanticipated adaptations, thereby recognizing the importance of phenomena such as diffusion of innovation, experimentation, adaptation, emergent change, path dependence, windows of opportunity, and assimilation gaps. Inclusion of these factors is at least partly inconsistent with project-oriented viewpoints, which often treat unanticipated opportunities and adaptations as problems rather than opportunities and categorize them under pejorative headings such as "requirements creep" and nonconformance. Although uncontrolled projects involve many obvious problems, over-controlled projects and systems may assign higher priority to project schedules and system consistency than to business benefits and system effectiveness. Related tradeoffs occur in any significant project or system and should not be ignored or automatically treated as undesirable by a life cycle model that attempts to describe reality.

REASON #9: CLARIFYING RESPONSIBILITIES OF IS AND BUSINESS PROFESSIONALS

> *Summary: Treating IT-reliant work systems as the core of the IS field will help in clarifying and communicating about responsibilities of IT and business professionals.*

Figure 7 summarizes typical responsibilities of IS and business professionals across the phases of a work system life cycle. Effective collaboration across a work system life cycle requires clarification of those roles and responsibilities, especially since the IT group typically lacks the authority to manage or enforce changes in work practices.[10] Viewing the IT artifact as the core of the IS field would not lead as directly to this type of clarification because it would place more emphasis on hardware and software rather than on how work systems operate and change, which is the basis of understanding the division of labor between business and IT professionals.

REASON #10: COMMUNICATING WITH BUSINESS PROFESSIONALS

> *Summary: Treating IT-reliant work systems as the core of the IS field will help in communicating with business professionals because IS/IT professionals will be more aware of what is important to business professionals, more able to communicate with them in business terms, and less likely to dwell on technical details business people don't care about.*

Communication and collaboration between business and IT professionals is often problematic. Their concerns are often quite different and sometimes the two groups seem to speak different languages. Often, IT professionals focus on the technology rather than how the technology can help IT users perform their work. Users may become overwhelmed by technical details and may be unwilling or unable to express their business needs clearly. Users may also be unable to visualize what current computerized tools can and cannot do, and may request capabilities that are too simple or too complex. A common result is unrealistic expectations, poor communication, and frustration, all of which lead to failed projects, poorly re-engineered business processes, and ineffectual information systems. These difficulties are one of the reasons why the original goal of the work system method was to help business professionals analyze systems for themselves and draw their own preliminary conclusions that might help them in subsequent discussions with IT professionals.

[10] Accordingly, Strassmann [1997, p. 395] recommends that IS managers "not get in the position of having to document operational benefits such as revenue gains, market share improvement, inventory reductions, product quality gains, or enhancement of customer service." He suggests IS managers should "leave all such recommendations to line executives who are directly responsible for them."

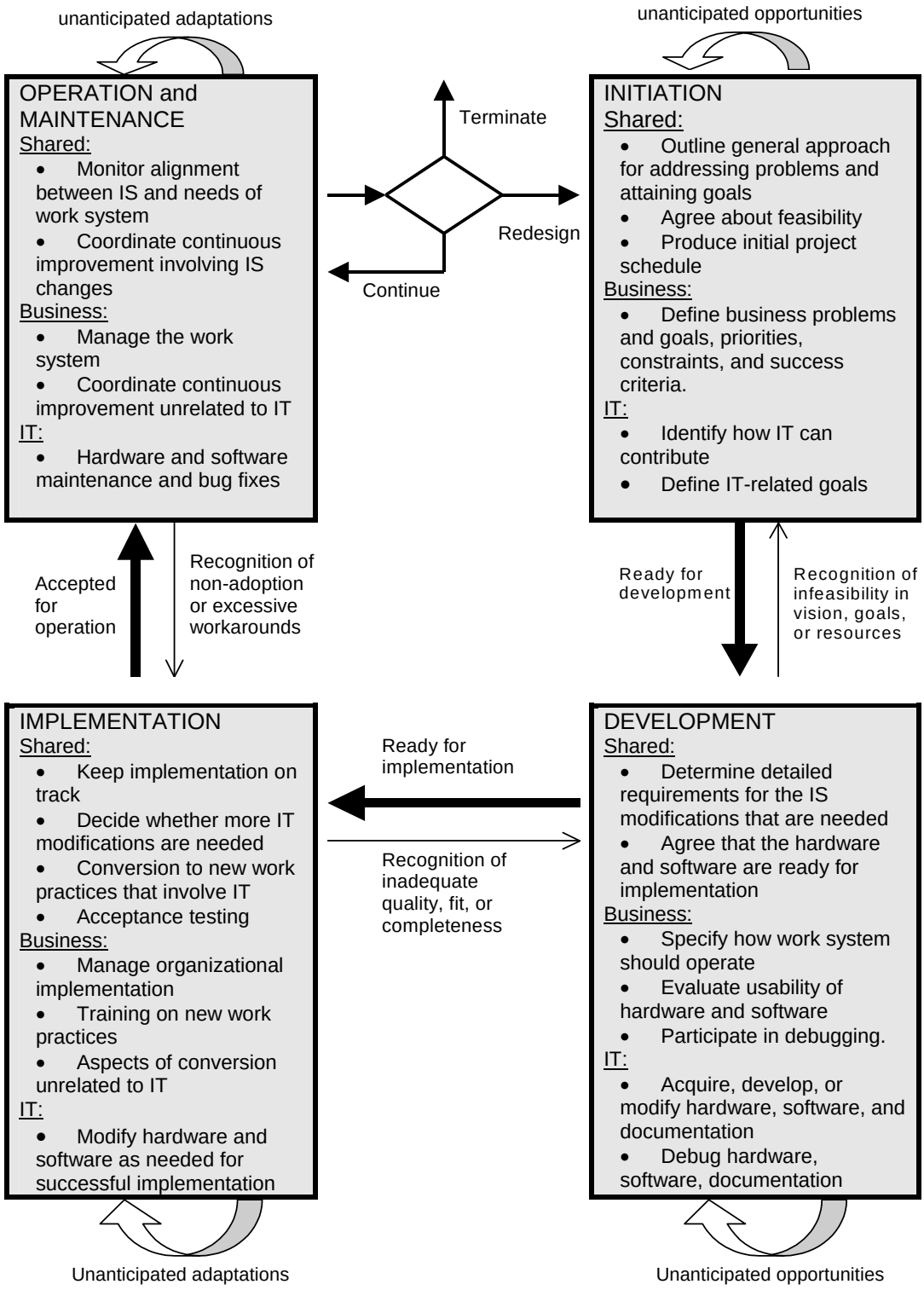


Figure 7. Typical Roles and Responsibilities across the Work System Life Cycle

REASON #11: PENETRATING TECHNO-HYPE AND REDUCING TECHNO-CENTRISM

Summary: Treating IT-reliant work systems as the core of the IS field will help both business and IT professionals penetrate techno-hype by encouraging them to ask how the adoption of any particular technology might change the operation of specific work systems and improve system performance.

Treating the IT artifact as the core of the IS field is conscious acceptance of techno-centrism. Treating IT-reliant work systems as the core of the IS field reduces techno-centrism because it conceptualizes technologies as tools used within work systems. The work system and its performance become the headline, rather than the features and benefits of the technology.

Use of the work system framework and work system life cycle model (or similar models) encourages asking two questions that help directly in penetrating techno-hype. The first question is "how will this specific work system change if we adopt the proposed technology?" Placing the technology within a particular work system puts the work system in the foreground. In many cases, the significant problems and opportunities for that work system do not deal with the issues addressed by the technology at all. In some cases, it should become apparent that no one understands the work system well enough to say how the proposed technology would make a difference. In other cases it should become apparent that the adoption of the new technology might "provide new options or capabilities" or might be nice for "technical reasons," but that the work system participants do not intend to change their work practices and will simply adapt the new technology to do exactly what they did in the past. Focusing on work system issues from the outset should lead to more skepticism about the "strategy" of using new technology to replicate old work practices as the first step in an implementation effort.

The second question is "what would we have to do to adopt the proposed technology, including any technical development and organizational implementation that must take place?" In a few rare cases, the technology may be a magic bullet that can be used with minimal effort to generate substantial benefits. With the possible exception of a few minimally structured technologies such as instant messaging, the magic bullet aspects of the new technology will tarnish quickly as people realize that the technology by itself will not solve anything and that many other changes and substantial effort are required to generate significant benefits.

REASON #12: UNDERSTANDING INTERACTIONS BETWEEN IS AND CULTURE

Summary: Treating IT-reliant work systems as the core of the IS field will help in understanding the interactions between information systems and organizational culture, and especially in realizing that links between information systems and culture are mostly second order effects. The first order effects are links between work systems and culture; the information systems reside in the background supporting the work systems.

"Poor fit with the culture" is a common explanation of why particular information systems encountered unanticipated resistance and never met expectations, whether or not they eventually operated in some manner. Almost anyone in the IS field would probably agree that a mismatch between a system and an organization's culture spells trouble both because it will generate additional resistance during implementation and because it will cause continuing conflict after a system is operational. On the other hand, information systems are sometimes implemented as part of an effort to change a culture. For example Davenport's [1998] article on enterprise systems quotes an executive who said, "We plan to use SAP as a battering ram to make our culture less autonomous." Regardless of whether the intention is to maintain the organization's culture or to change it, methods for analyzing the mutual impacts of systems and culture are needed.

Despite the important impact of culture on the success of projects and operational systems, most methods currently used for analyzing and designing information systems downplay or ignore issues related to culture and provide no help in treating these issues rigorously. For example, the terms "culture" or "organizational culture" appear in the index of only one of four

recent systems analysis and design texts (2001 or 2002 editions) that happen to be on my bookshelf. In combination the four books contain 2645 pages, but only one page about culture or organizational culture that can be found through the indexes at the back of the books.

Going beyond the easy generalization that information systems should match organizational culture requires a way to describe and analyze the fit between a particular organization's culture and a particular system's proposed or current functions and characteristics. Incorporating culture-related issues into systems analysis and design methods involves defining the concept of organizational culture, identifying relevant cultural variables, and using structuration theory, organizational change theory, or other ideas for describing how culture-related variables affect or enact important phenomena.

The question at hand is whether treating IT-reliant work systems as the core of the IS field leads to better culture-related analysis than treating IT artifacts as the core of the field. Consider typical culture-influenced activities within a work system, such as communication, operational tasks, management activities, decision-making, coordination, and knowledge and training activities. In particular situations, some of these activities are affected by IT artifacts and others are not affected by them. Ideally IT artifacts support the activities they touch, but this support is often ineffective for a variety of reasons, including mismatch with the culture and/or the details of the work system. In general, the link between work systems and culture is far more direct than the link between IT artifacts and culture. The work systems enact the culture, whereas at best the IT artifacts support the work systems and therefore are a step removed from directly affecting or being affected by the culture. Accordingly, the analysis of mutual impacts of culture and systems should emphasize the work system level rather than the IT artifact.

REASON #13: UNDERSTANDING VARIOUS TYPES OF IS

Summary: Treating IT-reliant work systems as the core of the IS field will help in understanding the operational dynamics of different types of information systems. Many of the important phenomena for specific types of IS will be phenomena of work systems in general rather than the unique characteristics of specific types of information systems.

Are different types of information systems basically different types of IT artifacts or are they better described as different types of work systems? If they are viewed as different types of IT artifacts, their structure, operation, and performance will be evaluated largely in terms of models, algorithms, hardware, and possibilities of use as a tool. If they are viewed as different types of work systems, their structure, operation, and performance will be viewed in terms of how these work systems operate and how well they operate. In other words, a given company might view CRM as an IT artifact to be purchased and installed or as one or more work systems related to dealing with customers and customer data. A similar distinction applies for other types of systems such as CAD, CIM, MRP, and even data warehouses. For teleconferencing, GSS, and other IT artifacts with less built-in structure, the analogous comparison is between the technical capability of supporting meetings and the work system of holding group meetings involving particular people in a particular situation.

It would be interesting to see whether the failure rate of various types of IT artifacts is correlated with the extent to which organizations view their implementation as a work system project rather than a software project. Consider, for example, the frequent discussions of the high failure rate of CRM. The first page of a Google search on "failure rate of CRM" in March, 2003 found failure rates from 40% to 60% attributed to Gartner, Meta Group, and Giga Information Group and others. Ignoring suspicions about the data collection that generated these findings, it seems plausible to me that many of the failures viewed CRM as software to be installed rather than as a set of work systems that handle customer relationships and might be improved through a variety of changes including acquisition and implementation of better IT artifacts. Garcia et al [2002] reports a case study that fits this pattern. My guess, and it is only a guess, is that organizations that view CRM as one or more work systems obtain better average results than the companies that view CRM as a set of IT artifacts to be installed and used.

REASON #14: UNDERSTANDING DIFFUSION AND ADOPTION OF IT INNOVATIONS

Summary: Treating IT-reliant work systems as the core of the IS field will help in understanding the diffusion and adoption of IT innovations by clarifying that adoption means on-going use within recognizable work systems.

Many important IT innovations encountered extremely lengthy delays between initial acquisition and full deployment. For example Fichman and Kemerer [1999] report surprising assimilation gaps related to deployment of three IT methodological innovations that emerged in the 1980s, relational databases, 4GLs, and CASE. Defining nontrivial deployment as use on 25% of new applications, they found that 54 months after the initial acquisition, only 59% of the companies had deployed RDBs, 45% had deployed 4GLs, and 24% had deployed CASE. Although immaturity and other shortcomings in the tools surely accounted for part of these assimilation gaps, it is possible that many other issues were related to insufficient impetus to change work systems. In other words, as in the earlier comment about CRM failure rates, it is possible that genuine intention to change work systems is an important success factor when applying IT innovations.

REASON #15: ORGANIZING AND CODIFYING CONCEPTS AND KNOWLEDGE RELATED TO IS

Summary: Treating IT-reliant work systems as the core of the IS field will help in organizing and codifying concepts and knowledge related to IS. The core of the concepts and knowledge is about work systems in general. Information systems, projects, supply chains, and other special cases should inherit properties from the more general cases.

Many of the frustrations with the current IS discipline reflect its existence as a loose, unsettled conglomeration of partly overlapping but seemingly immiscible slices of terminology and knowledge related to a wide range of fields such as conceptual modeling, organization behavior, total quality management, human communication, coordination theory, information theory, computer science, and microeconomics.

Alter [2002d] outlines an approach for organizing and codifying IS concepts and knowledge in the form of a terminological ontology called Sysperanto. A play on Esperanto, a consciously developed "universal" language almost no one speaks, the name Sysperanto is meant as a metaphor combining generality (covering the IS field), vocabulary (identification of terms), and structure (internally consistent organization). If successful, Sysperanto will identify and organize core concepts that business professionals, IT professionals, and IS researchers can use for describing and analyzing systems in organizations. It will also help in codifying the disparate and inconsistent propositions, methods, and findings that constitute the current state of IS knowledge. These disparities and inconsistencies surely contribute to the frequently discussed lack of accepted theory in the IS field.

The idea of developing Sysperanto started with Alter [2000], which found that 10 papers published in close proximity in *CAIS* used completely different meanings for basic terms such as system, user, stakeholder, implementation, and requirements. Many people observed this phenomenon; the question is whether anything can be done about it. A follow-on paper, [Alter 2001a], proposed that the fundamental concepts of information systems are mostly about work systems. Sysperanto is an attempt to take the next step in developing that idea.

Sysperanto is designed around a meta-model based on four assumptions that are all consistent with treating IT-reliant work systems as the core of the IS field:

1. The concepts in the IS field can be organized around the elements and properties of work systems.
2. Information systems, projects, and supply chains (and subordinate special cases) are all special cases of work systems.
3. The special cases of work systems should inherit most of the elements and properties of more general types.

4. Both practitioners and researchers understand business and organizational reality by slicing it in accordance with different groups of concepts, associations, and understandings; these different "slices" (such as communication, decision making, and information processing) involve their own internal logic but may overlap to some extent.

Based on these assumptions, Sysperanto organizes concepts and generalizations about work systems and work system types, starting with the most general type, "work systems in general." Figure 8 presents the underlying meta-model. Work system types are summarized in terms of the nine work system elements in the work system framework in Figure 1. Each of those elements is understood through a series of slices. For example, business process, decision-making, communicating, and coordinating are four of the slices that apply to the work practices within a work system. Each of the slices for the work system element "work practices" provides a separate vocabulary of properties related to work practices. The properties themselves may be components, actions or functions, characteristics, performance variables, relationships, phenomena, and generalizations. An attempt to flesh out the properties at the work system level (starting with concepts from Alter [2001a]) is not yet complete. The next step will attempt to determine the extent to which those properties are truly inherited by information systems and projects, and also the extent to which the special cases have their own unique properties. The underlying hope, definitely not proved at this point, is that most of the important concepts at each level below "work system in general" will be inherited from a higher level.

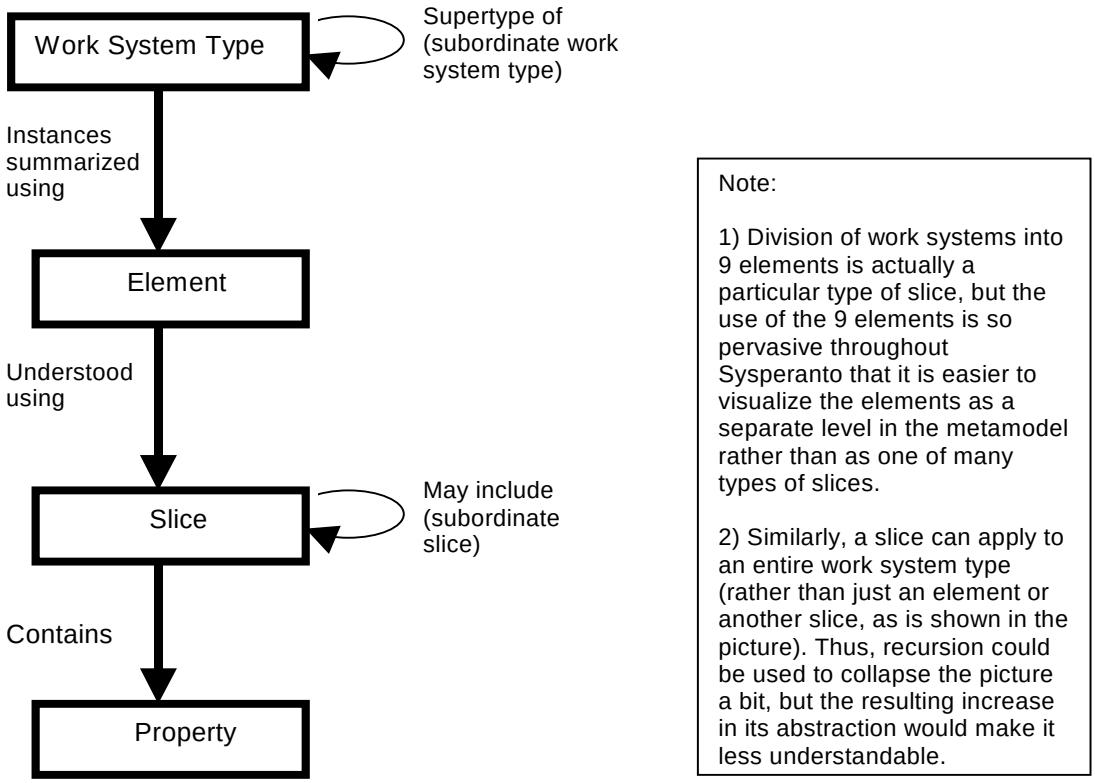


Figure 8: Basic Structure of Sysperanto's Meta-Model

REASON #16: MAKING IS RESEARCH MORE VALUABLE

Summary: Treating IT-reliant work systems as the core of the IS field will make IS research more valuable by providing insights about its generalizability, by motivating a

range of concerns wider than just those related to IT artifacts, and by helping to see which important issues are truly unstudied or unresolved.

The purpose of research is to test existing ideas and develop new knowledge. Ideally, whatever is viewed as the core of the IS field should help in making IS research as valuable as possible. It should help in identifying important research topics, in developing and testing theories, performing research, explaining the findings to researchers and practitioners, and ultimately influencing practice. The previous section (reason #15) argued that treating the core of the field as IT-reliant work systems provides a potentially valuable way of organizing and codifying concepts and knowledge related to IS. Organizing existing knowledge also helps in seeing which areas are well understood and which have high potential for valuable research because little is known, because the concepts are insufficient, or because disagreement is substantial. Treating IT artifacts as the core does not have the same advantages because of the small number of concepts that apply to IT artifacts as a class. In addition, the nine elements in the work system framework encompass a large number of important topics that are not directly associated with IT artifacts (as most people would use that term[11]). Among others, those topics are related to work practices, work system participants, information, products and services produced, and customers.

Lee and Baskerville's [2003] article on generalizability of IS research helps in appreciating the benefits of treating IT-reliant work systems as the core of the IS field. Their article begins by noting, "generalizability is a major concern to those who do, and use, research. Among other things, it refers to the validity of a theory in a setting different from the one where it was empirically tested and confirmed. … The generalizability of an IS theory to different settings is important not only for purposes of basic research, but also for purposes of managing and solving problems that corporations and other organizations experience in society." (p. 221). Lee and Baskerville provide a framework (p. 233) identifying four types of generalizability related to empirical (E) statements and theoretical (T) statements.

- EE: generalizing from data to description
- ET: generalizating from description to theory
- TE: generalizing theory to description
- TT: generalizing from concepts to theory.

At several points they refer to a basic issue about generalizability, "as a consequence of Hume's truism [explained in their article], a theory may never be generalized to a setting where it has not yet been empirically tested and confirmed." (p. 241) On the other hand, their discussion of TE generalizability notes, "practitioners who read a theory reported in a journal article do not necessarily have the time, resources, or desire to perform a scientific test of the theory in the setting of their own companies prior to application of it." (p. 238).

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[11] As mentioned earlier, Orlikowski and Iacono [2001] identify five conceptualizations of the IT artifact. As noted in Alter [2003b], Benbasat and Zmud [2003] offer an additional version that is somewhat similar to Orlikowski and Iacono's "ensemble view" but in its specifics does not fully encompass the nine elements included in a basic understanding of an IT-reliant work system. In contrast, typical understandings of the term *artifact* are reflected in much simpler dictionary definitions such as:

- something created by humans, usually for a practical purpose; *especially***:** an object remaining from a particular period [*Merriam Webster Dictionary*]
- something characteristic of or resulting from a human institution or activity [*Merriam Webster Dictionary]*
- a structure or feature not normally present but visible as a result of an external agent or action [*American Heritage Dictionary, 4th edition]*
- an inaccurate observation, effect, or result, especially one resulting from the technology used in scientific investigation or from experimental error: [*American Heritage Dictionary, 4th edition]*

Treating IT-reliant work systems as the core of the IS field is potentially helpful in relation to all four types of generalizability because it would provide an organized vocabulary of components, characteristics, performance variables, and other types of properties related to different ways of looking at each work system element, not just IT artifacts. The cataloguing and use of both concepts and theories could be facilitated by the inheritance of concepts and theories from more general work system types, such as projects in general or information systems in general, to less general types, such as specific types of projects or information systems. In particular, assumptions about inheritance relationships could motivate TT questions about whether and under what circumstances particular concepts and theories truly are meaningful for special cases. Those questions could motivate empirical research that explores a deeper level of system-related phenomena. Moving in this direction might reduce the percentage of research devoted to verifying and re-verifying the importance of widely recognized factors such as management support, resources, and competence that apply in most work systems regardless of whether the technology involves data warehousing, ERP, CRM, or is even absent.

Lee and Baskerville's discussion of generalizability also shows why adopting a work system-centric view might help in addressing substantive issues underlying the frequent debates about relevance and rigor in the IS field (e.g., Keen [1991], Benbasat and Zmud [1999], Davenport and Markus [1999], Gray [2001]). Research rigor frequently calls for greater care about the limits of generalizability, whereas relevance calls for greater attention to new concepts and theories that provide some insight or guidelines even if they haven't been tested in a setting nearly identical to the one in which they are to be applied. As a practical discipline, IS should define itself in a way that facilitates practical applications of its concepts and research. The real world uses IT artifacts but operates through work systems.

REASON #17: STRENGTHENING LINKAGES BETWEEN IS AND OTHER DISCIPLINES

> *Summary: Treating IT-reliant work systems as the core of the IS field will help in recognizing ways the IS discipline differs from and contributes to other disciplines*.

The topic of whether IS is a discipline, how it is related to "reference disciplines," and whether it contains too much or too little diversity is discussed extensively in the literature (Keen [1980], King [1993], Swanson and Ramiller [1993], Benbasat and Weber [1996], Robey [1996], Benbasat and Zmud [2003]). Obviously, the IS field benefits greatly from the knowledge, insights, and methodologies of reference disciplines such as computer science, economics, psychology, decision analysis, organization behavior, and general management. Reference disciplines such as these typically focus on one or two of the work system elements and often view IT-related phenomena as background noise.

In a 2002 *MISQ* article, Baskerville and Myers [2002] argue that status as a reference discipline can be a two-way street, and that "perhaps the time has come for IS to become a reference discipline for others."(p. 1) They cite two examples that "show how earlier IS research has proved to be of value to others." One is Markus's [1983] study of IT and organizations, which compared three theories of resistance to IS implementation and concluded that resistance to technological change is not inherently dysfunctional, but rather is labeled as good or bad depending on the vested interests of the people doing the labeling. Their other example is research on business process reengineering starting with Davenport and Short [1990]. In neither of these cases is the main message really about IT artifacts. The observations about resistance to change are equally applicable to any significant change regardless of whether IT is involved. The same can be said about reengineering because its main message is about rethinking and redesigning work systems rather than about using any particular IT artifact in any particular way. In other words, the two exemplars chosen to illustrate the general value of IS research are papers written by authors associated with the IS field, but are actually about phenomena that are more general, that is, about work systems.

In their concluding section, Baskerville and Myers say, "the domain defined by the development, use, and application of information systems by individuals, organizations and society as a whole is too large for the IS community. But we believe that IS can take a leadership

position within this domain. Taking a position of leadership means transforming our research agendas and clearly explaining the broad value of our research discoveries." (p. 11)

Table 1 supports their conclusion by listing topics in which IS research can contribute to the knowledge of both reference disciplines and related applied disciplines such as marketing and

Table 1. Areas in which the IS Field Might Contribute to Related Disciplines

Related Discipline	Possible Contribution of the IS Field
Computer science	▪ Uses of IT within work systems, which should affect the functions and features of future technologies ▪ Aspects of usability and ease of use of IT within work systems, plus training related to both IT capabilities and the work system ▪ Work systems for installing, implementing, and maintaining IT artifacts ▪ Viewing systems analysis, design, and programming in work system terms (e.g., seeing why apparently well designed system development technologies such as CASE accomplish little until integrated into the IT organization's work systems) ▪ Tracing the diffusion of IT-related innovations through adoption in work systems
Management	▪ Management as an IT-reliant work system ▪ Coordination and integration of effort within and between IT-reliant work systems ▪ Designing and implementing incentives for participants in IT-reliant work systems ▪ Alignment of work systems and information systems with espoused corporate strategies ▪ Personal and organizational issues related to IT-enabled change (which inherently involves work systems)
Organizational behavior	▪ Group and individual behavior within IT-reliant work systems ▪ Impacts of business processes and work system environment on people ▪ Communication patterns in virtual and non-virtual work systems ▪ Planned change, as exemplified by work systems (projects) for configuring and implementing ERP systems
Individual psychology	▪ Individual emotions, perceptions and coping mechanisms at times of stress, e.g., during ERP implementations or high stakes real time decision making ▪ Ability of individuals to change as work arrangements and skills requirements change ▪ Cognitive capabilities and limitations as revealed in IT-reliant work systems ▪ * Impacts of age and other human characteristics on ability to perform work and learn new skills (e.g., use of new IT and adaptation to new IT-reliant work practices)
Economics	▪ Supply and demand in relation to resource allocations and labor assignments within IT-reliant work systems ▪ Using work system concepts to understand the economics of information products and services ▪ Transaction cost economics in action in IT-reliant work systems ▪ Applications of agency theory within IT-reliant work systems ▪ Impacts of business process characteristics on productivity and other performance variables within IT-reliant work systems
Operations management	▪ Characterization of different types of work systems based on the form and content of IS usage ▪ Techniques for controlling business processes ▪ Techniques for optimizing the design of business processes ▪ Techniques for optimal decision making within work systems ▪ Management of highly automated work cells and factories ▪ Computer integrated manufacturing in action within work systems
Finance and accounting	▪ Applying work system principles to work systems related to finance and accounting ▪ Use and misuse of computerized accounting information in work systems related to managing firms ▪ IS-related applications of real options and other approaches to financial decisions related to improving work systems
Human resources	▪ Using work system concepts to appreciate special requirements and conditions for system development personnel ▪ Work systems for training new IT employees, integrating them into the organization, and retaining them ▪ Issues related to de-skilling and work system performance
Marketing and ecommerce	▪ IT-reliant work systems related to products and purchase decisions ▪ Alternate forms and advantages and disadvantages of Web-based commerce ▪ Ecommerce as a work system ▪ Integrating traditional stores with online stores ▪ *Customer relationship management (CRM) in action (viewed as a work system)
Project management	▪ Projects as work systems ▪ Unique issues related to different types of IS-related projects ▪ * Collection and use of project data to influence future project decisions

finance. Consistent with the theme of this article, all of the topics involve IT-reliant work systems. Many of these topics would not be in the table if the IS field were viewed as focusing on IT artifacts. Some might view a conscious attempt to cast our net more broadly as an attempt to invade territory often associated with other disciplines and other functional areas of business. Academic boundaries might become a bit more unsettled, especially as the differences between IS, operations management, and general management continue to collapse. Although practical difficulties must be overcome, the IS field's future should be influenced more strongly by maximizing its future value than by minimizing conflicts concerning current academic boundaries.

REASON #18: SUPPORTING THE RESEARCH AGENDA PROPOSED BY ORLIKOWSKI AND IACONO

Summary: Treating IT-reliant work systems as the core of the IS field will support greater engagement with IT artifacts because technological artifacts are integral parts of work systems and therefore should not be ignored when work *systems are studied as systems.*

A final reason for moving toward IT-reliant work systems as the core of the IS field is to support the research agenda that Orlikowski and Iacono present in the final section of their article. They believe it is necessary to "stop taking IT artifacts for granted" and that "all IT research will benefit from more careful engagement with the technological artifacts that are at the core of our field." They propose theorizing about IT artifacts starting from five premises:

- IT artifacts are not natural, neutral, universal, or given.
- IT artifacts are always embedded in some time, place, discourse, and community.
- IT artifacts are usually made up many fragile and fragmentary components, whose interconnections are often partial and provisional and which require bridging, integration, and articulation in order for them to work together.
- IT artifacts are neither fixed nor independent, but they emerge from ongoing social and economic practices.
- IT artifacts are not static or unchanging, but dynamic.

In combination, those premises lead toward the type of "ensemble" view exemplified by Kling and Scacchi's (1982) concept of 'web models' of computing, according to which IT is "more than tools deployed on the desktop or factory," but rather is "the ensemble or 'web' of equipment, techniques, applications, and people that define a social context, including the history of commitments in making up that web, the infrastructure that supports its development and use, and the social relations and processes that make up the terrain in which people use it." (Orlikowski and Iacono [2001, p. 122])

Ironically, even though this article stemmed from disagreement with Orlikowski and Iacono's belief that "the IT artifact" is the core the IS field, its proposal to shift toward viewing IT-reliant work systems as the core of the field would strongly support the types of theorizing and research Orlikowski and Iacono believe the IS field needs. The IS field may be the result of the concerns of "computer people" who recognized the importance of delving more deeply into the application and development of technology. But viewing the IT artifact as the core of today's IS field does little to encourage use of the ensemble-like views needed to pursue the five premises Orlikowski and Iacono suggest. Viewing the IT artifact as the core of the IS field makes it easier to look at IT more or less like a vaccine or other "treatment" that is received by users or subjects but is inherently separate from them. The most straightforward topics to imagine and analyze involve the structure and details of the treatment (the computational view), the use of the treatment (the tool view), the perceptual and financial issues surrounding the treatment (proxy view), and the general milieu in which the treatment is used (the nominal view). In contrast, viewing IT-reliant work systems as the core of the IS field would encourage greater use of ensemble views because work systems necessarily encompass participants, work practices, information, and technology and because the work system life cycle is about changing work practices rather than just creating or modifying IT artifacts. A shift in this direction would make it more likely that IS research will

engage the richness of the issues related to developing, implementing, and using information systems in organizations. IT artifacts would be an integral part of the discussion of specific IT-reliant work systems, The inclusion of technology and the other work system elements would encourage engaging the many topics related to IT in use in organizations.

IV. CONCLUSION

A distinguished member of the IS community responded to a previous paper of mine on work systems and information systems by saying, in effect, that information system papers belong in information system journals and work system papers belong in organizational management or behavior journals. In other words, there is some kind of boundary around the field of information systems, and serious consideration of work systems is outside that boundary.

This paper's 18 reasons expressed a contrary view by arguing that IT-reliant work systems not only are relevant to the IS field, but should be considered the core of today's IS field. A shift in that direction would encourage broader and more genuine engagement with a range of important concerns in IS research and IS curricula by:

1. establishing a clearer and more balanced view of the role and importance of IT
2. attending to important phenomena and issues in the surrounding context
3. recognizing fully that human participants play integral roles in the systems we study
4. addressing IS success in terms of business operations and results
5. addressing IS costs and productivity in the context of the systems that are served
6. organizing IS risk factors and success factors so they can be used more effectively
7. incorporating more of the relevant realities in systems analysis and design methods
8. avoiding unnecessarily techno-centric views of system life cycles
9. recognizing project roles other than those directly related to IT
10. improving communication with business professionals
11. detecting and penetrating techno-hype
12. appreciating the extent of mutual impacts of IS and culture
13. clarifying the dynamics of different types of information systems
14. clarifying the diffusion and adoption of IT innovations into work systems
15. organizing and codifying knowledge in the IS field
16. engaging business and organizational issues more fully in IS research
17. encouraging two-way exchange between IS and other disciplines
18. supporting the research agenda proposed by Orlikowski and Iacono.

We may have started as computer people, but moving forward under that banner will limit the value of our research and may further marginalize us in academia as IT becomes increasingly commonplace and unmysterious. Casting a wider net will open new, high value areas of research and teaching. Viewing IT-reliant work systems as the core of the IS field will encourage genuine engagement with IT artifacts because it will encourage consideration of those artifacts, not just in isolation or statistical aggregation, but in the richness of the settings in which they are developed and used.

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