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Using Work System Theory to Achieve Greater Business Value from ERP by Exploring Alternative Design Spaces

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

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

Abstract

The main goal of the Enterprise Systems and Business Process Capability Workshop at ECIS 2011 is to discuss ways to achieve greater business value from ERP. This paper explains how various aspects of work system theory (WST) can be applied to achieve that goal by assuming that the underlying "design spaces" encompass much more than the features, configuration, and limitations of ERP software. It uses WST concepts to identify directions for achieving business value that might not be considered thoroughly in ERP implementations that focus primarily on converting from legacy software to ERP software.

This paper starts by summarizing basic premises concerning the relationship between work systems and ERP. Focusing on the context of ERP usage, it explains the elements of the two central frameworks in WST, the work system framework and work system life cycle model. Instead of viewing the context as ERP usage or ERP projects, viewing the context as ERP-enabled work system improvement focuses attention on a number of paths toward greater business value that may not be used effectively in current practice. The paper discusses five relevant design spaces that are mentioned rarely, if at all, in current practice. Part of the paper's contribution is in making those ideas more explicit through framing the discussion around aspects of WST. Another part of its contribution is in providing a new way to discuss topics such as workarounds, add-ins, and exceptions that are sometimes controversial issues when ERP is used.

Keywords: Enterprise system, benefits of ERP, work system theory, work system method

ERP Projects or Work System Projects Enabled by ERP?

Adoption and usage of ERP is notoriously complicated and risk prone. Many projects start with high hopes about establishing world class business processes, providing much better access to transaction information, improving coordination across business functions, improving overall efficiency, and serving customers more effectively. Unfortunately, the variability in outcomes is extremely high, with some projects touted as great successes by ERP vendors, others reported as fiascos in trade periodicals, and many between the extremes.

This paper focuses on achieving greater business value from ERP by thinking in a different, but highly organized way about ERP projects and ERP in use. It explains how to see ERP applications as though the headline is performance improvement rather than ERP implementation or ERP usage. It does this by explaining ways in which aspects of work system theory (Alter, 2006b, 2008, 2010f) provide insights about how to achieve additional benefits from ERP beyond those that occur from converting to more standardized processes and increasing data availability. It is based on the following premises:

- Businesses and other enterprises can be subdivided into work systems that operate together to serve the business's customers and to maintain internal coordination, cooperation, and productivity. 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.

- The performance of work systems, individually and in combination, is a key determinant of the performance of businesses and other enterprises.
- ERP should be viewed as technical infrastructure that is shared across multiple work systems. ERP infrastructure enables but does not generate business performance, which is determined more directly by the combined performance of individual work systems that use various components of ERP suites.
- Projects that install and configure ERP should be viewed as work system improvement projects rather than as software-centric ERP projects.
- The processes and activities that actually occur in work systems may deviate from process logic in ERP software for a variety of reasons including special cases, exception conditions, errors, intentional workarounds, and local situations that cannot be represented in the ERP software. Thus, contrary to vendor exhortations about "best practices" inherent in ERP, deviation from process logic expressed in ERP software may have positive or negative impacts on work system and business performance.
- Since work systems interact while contributing to enterprise performance, the configuration of ERP for one work system may have positive or negative impacts on other work systems.
- Process rigidity related to the limitations of ERP software can be ameliorated through appropriate combinations of changes in ERP parameters, changes in other aspects of work systems, appropriate workarounds to address transient issues, and analytical and consulting help to use ERP and related software more effectively.

As is apparent from accounts of careful ERP implementations such as the NIBCO case (Brown and Vessey, 2000), most of these premises are consistent with an experienced ERP practitioner's recognition that ERP projects are fundamentally about improving business processes and business performance rather than just installing software or enforcing predefined notions of how transactions should be performed. Part of this paper's contribution is in making some of that practitioner knowledge more explicit and more easily teachable. In addition, WST potentially helps managers, business professionals, and ERP experts focus on achieving business value through a variety of paths that are not usually considered fully. This paper's approach to work systems in an ERP context provides a new framing of the search for business value without being a total departure from views of many experienced ERP consultants and practitioners.

This paper is a conceptual contribution to the discussion about attaining greater business value from ERP by using selected aspects of work system theory (WST), which was developed to help business professionals understand and analyze IT-reliant systems in their own organizations, (Alter 2006b, 2008, 2010f). Based on the two central frameworks in WST, it presents ideas leading to paths for attaining greater business value that may not be considered fully or may not be considered at all in current practice and in current research. After a brief summary of WST, this paper shows how the two central frameworks in WST help in seeing the range of possible changes and interventions that may contribute to reaping benefits from ERP instead of simply performing transactions and sharing information a bit more cleanly.

Background about Work System Theory

Work system theory (WST) is an evolving, multifaceted body of theory (Gregor, 2006, pp. 611, 629) for describing, understanding, analyzing, and designing IT-reliant systems in organizations. WST was designed to illuminate typical sociotechnical systems through which organizations operate, although much of it is also relevant to totally automated systems (Alter, 2010a, 2010f). WST combines static and dynamic big picture views of work systems in organizations. Work systems are systems 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. Organizations consist of multiple work systems that can be aggregated or decomposed in many different ways depending on the purpose of the analysis.

WST's evolution to date stems from a project extending over two decades that attempted to develop a systems analysis method that can be used by business professionals for their own understanding and can support communication between business and IT professionals. That research effort anticipated many of the goals of design science research (Hevner et al., 2004; Winter, 2008), such as relevance, testing, and iterative improvement. Work system concepts and methods were developed through numerous iterations.

The initial ideas were an attempt to distill, combine, and simplify industry experience plus ideas from many sources including the general systems, sociotechnical, and system development literature. Over many years, MBA and Executive MBA students used successive versions of a work system analysis template to write group papers analyzing IT-reliant work systems in their own organizations. The papers from each semester revealed confusions, knowledge gaps, and other problems that led to revisions in the work system analysis outlines for subsequent semesters. For example, Alter (2006a) identified pitfalls observed in 202 group papers between 1997 and 2002 and approaches that were attempted for minimizing those pitfalls. More recently, Truex collected over 250 work system analysis papers by MBA students, the first batch of which were the source data for Truex et al. (2010). Table 1 identifies illustrative examples of work systems that were analyzed. Although each of those work systems is named in terms of what might be viewed as a business process, the work systems involve much more than a business process per se, as can be visualized by considering the work system framework shown in Figure 1.

Table 1. Examples of work systems selected and analyzed by employed MBA students

• Renewing insurance policies • Receiving materials at a large warehouse • Approving real estate loan applications • Performing background checks for job candidates • Performing financial planning for rich clients	• Planning and dispatching trucking services • Scheduling and tracking health service appointments • Operating an engineering call center • Administering grant budgets • Invoicing for construction work	• Finding and serving clients of a marketing consultancy • Determining government incentives for providing employee training • Planning for outages in key real time information systems • Acknowledging gifts at a high profile charitable organization

At the core of WST are two central frameworks, the work system framework (Figure 1) for summarizing how a work system operates and the work system life cycle model (Figure 2) for summarizing how a work system evolves over time through a combination of planned and unplanned change. WST contains additional layers of concepts that support analysis and design efforts and that are useful in research about IT-reliant systems in organizations.

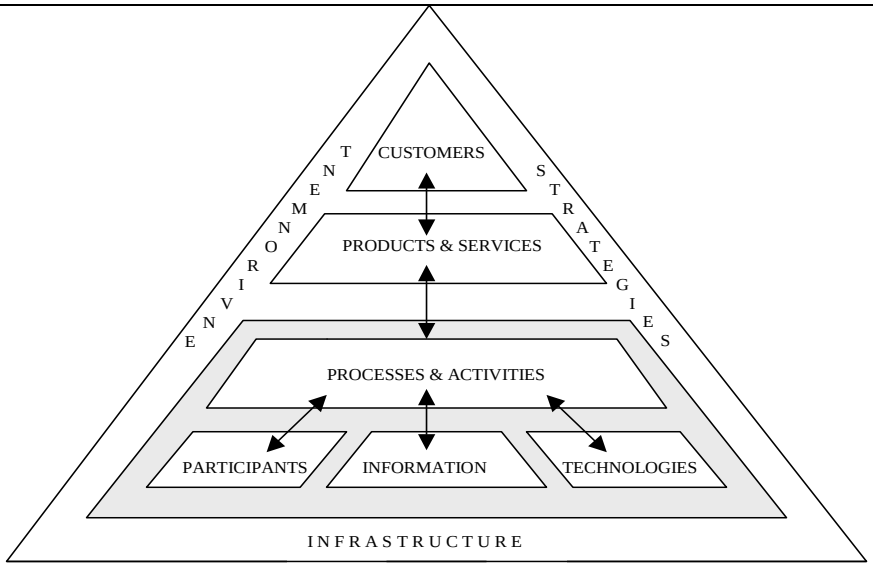

Figure 1. The Work System Framework (as updated in Alter (2008))

Work system framework. The nine elements of the work system framework (Figure 1) are the basis for describing and analyzing an IT-reliant work system in an organization. The framework outlines a static view of a work system's form and function at a point in time and is designed to emphasize business rather than IT concerns. It covers situations that might or might not have a tightly defined business process and

might or might not be IT-intensive. Figure 1 says that work systems exist to produce products and services for its customers. The arrows say that the elements of a work system should be in alignment.

Work system life cycle model. Shown in Figure 2, the other central framework in WST is the work system life cycle model (WSLC), which expresses a dynamic view of how work systems change over time through iterations involving planned and unplanned change. (Alter 2006b, 2008). The WSLC represents planned change as projects that include initiation, development, and implementation phases. Development involves creation or acquisition of resources required for implementation of desired changes in the organization. Unplanned changes, represented by inward-facing arrows, are ongoing adaptations and experimentation that change aspects of work systems or work system projects without separate allocation of significant project resources. For example, the inward facing arrow attached to the operation and maintenance phase is typically about small work system changes that do not require formal projects or allocation of significant resources. The inward-facing arrow for that phase can also represent emergent changes in practices or goals that occur over longer periods without conscious planning. Inward-facing arrows for development and implementation phases of formal projects represent emergent changes in intentions, designs, and plans based on new insights and knowledge after the initiation phase.

The WSLC differs fundamentally from the "system development life cycle" (SDLC), which is basically a project model rather than a system life cycle. Some current versions of the SDLC contain iterations, but even those are basically iterations within a project. "The system" in the SDLC is a basically a technical artifact that is being programmed. In contrast, the system in the WSLC is a work system that evolves over time through multiple iterations that combine defined projects and incremental changes resulting from small adaptations and experimentation. In contrast with control-oriented versions of the SDLC, the WSLC treats unplanned changes as part of a work system's natural evolution.

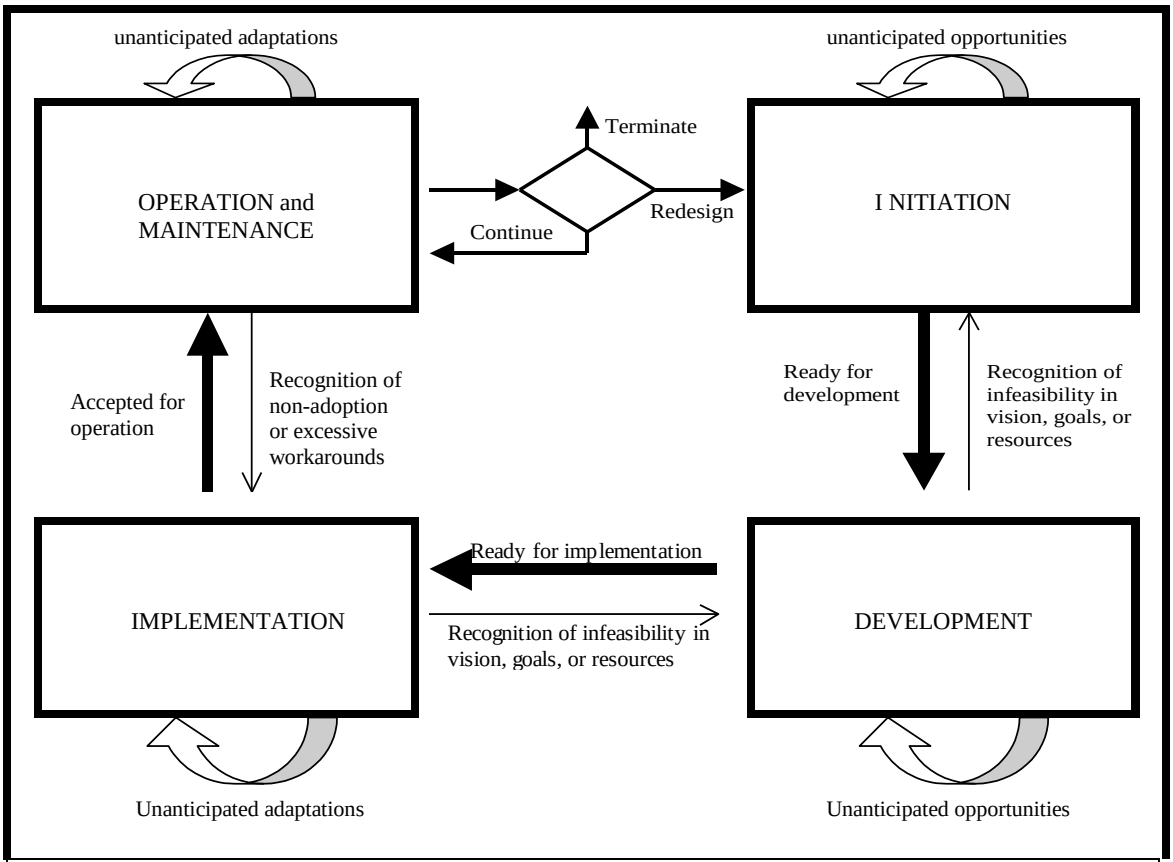

Figure 2. Work System Life Cycle Model (Alter, 2006b, 2008)

ERP Projects as Work System Improvement Projects

Both the work system framework and the work system life cycle model have implications for seeking business value from ERP. This section looks at those frameworks in the context of ERP and ERP projects.

Work System Elements in an ERP Context

The nine elements of the work system framework will be defined briefly. The indented statement under each definition explains how the defined term is relevant to ERP and ERP projects.

Customers. A work system's customers are recipients of a work system's products and services for purposes other than performing work activities within the work system. Customers of a work system may also be participants in the work system (e.g., patients in a medical exam, students in an educational setting, and clients in a consulting engagement).

>>> Since work systems exist to produce products and services for their customers, both ERP configuration choices and other evaluation and design decisions related to a work system should consider who are a work system's customers, what they want, and how they use whatever it produces.

Products and services. A work system's purpose is to produce products and services for its internal customers (such as employees) and/or external customers (such as economic customers of the firm).

>>> Analyzing, evaluating, or designing a work system without careful attention to the products and services that it produces is tantamount to ignoring its effectiveness.

Processes and activities. A work system analysis assumes that processes and activities summarize the way work is actually performed, including workarounds, special cases, and exception conditions. A work system analysis should be clear about the difference between documented or ideal work flows and the steps that are performed in reality. Furthermore, explicit identification of the other eight elements in the work system framework implies that the same steps might be performed with different participants, different information, and/or different technology. In other words, a work system is much more than just the business processes and activities that it contains or is supposed to perform.

>>> The processes and activities in a work system analysis include more than the steps outlined by ERP software even when ERP software plays an essential role in a work system. ERP software is part of the technology that is used in a work system. Other technologies may also be used, such as spreadsheets that keep track of information not included in the ERP database. Other important activities that are essential for work system success may not be reflected at all in the ERP software or database.

Participants. Participants are people who perform work within the work system, including both users and non-users of IT. Inclusion of the term *participant* instead of the term *user* avoids ignoring important participants who do not use computers. This minimizes confusion from referring to stakeholders as users, whether or not they actually use the technology in a work system that is being analyzed.

>>> The assumption that every participant in a work system is also a user of ERP is often incorrect. Participants are people who perform one or more steps in a work system's processes and activities. Participants may or may not be users of ERP. People who configure, install, and maintain the ERP software typically are not considered participants in a work system that uses the ERP software. Instead, they are considered participants in work systems that configure, install, and maintain ERP software.

Information. All work systems use or create information, which in the context of work system analysis and design can be expressed as informational entities that are used, created, captured, transmitted, stored, retrieved, manipulated, updated, displayed, and/or deleted by processes and activities. Typical informational entities include orders, invoices, warranties, schedules, income statements, reservations, medical histories, resumes, job descriptions, and job offers. A work system analysis views information as all information that is worth mentioning, regardless of whether it is stored in a computerized database.

>>> ERP software captures or provides only part of the information that is produced or used in many work systems. Analysis of a work system without reference to all of the relevant information, including

computerized information that is not in the ERP database and even non-computerized information that is used or generated, may ignore or hide important factors related to work system performance.

Technology. The technology within a work system includes hardware and software that are used directly by human participants and other hardware and software that may operate automatically after being launched by other work systems.

>>> Individual work systems use only a small subset of an ERP suite, which serves as infrastructure for multiple work systems. ERP software modules used by a specific work system are only part of the technology that it uses. It may use other types of technology, including BI software and spreadsheets.

Environment. This includes the relevant organizational, cultural, political, competitive, technical, regulatory, and demographic environment within which the work system operates, and that affects the work system's effectiveness and efficiency. Factors in a work system's environment may have direct or indirect impacts on its performance results, aspiration levels, goals, and requirements for change. Ignoring important factors in the environment may result in overlooking issues that degrade work system performance or even cause system failure.

>>> Consideration of the surrounding environment is equally important in work systems that use ERP software as in any other work system.

Infrastructure. This includes relevant human, informational, and technical resources that are used by the work system but are managed outside of it and are shared with other work systems. The ERP software modules that are used directly in a work system can be viewed as technology within that work system. The entire suite of ERP software can be viewed as a work system's technology infrastructure, which is shared with other work systems. The ERP database is part of the work system's informational infrastructure.

>>> Thus, ERP software and ERP databases are part of an organization's technical and informational infrastructure. Technical support staff and information analysts who occasionally help ERP users may be considered part of the relevant human infrastructure or may be considered participants in separate work systems that are devoted to helping people use ERP.

Strategies. The success of a work system depends in part on the enterprise strategy, organization strategy, and work system strategy. In general, strategies at the three levels should be in alignment, and work system strategies should support organization and enterprise strategies. Unfortunately, strategies at any of the three levels may not be articulated or may be inconsistent with reality or with beliefs and understandings of important stakeholders. Use of ERP can be part of a strategy at any of the three levels.

>>> Different firms pursue quite different strategies regarding ERP projects, ERP support, and ERP maintenance. This paper suggests an overall strategy of viewing ERP as a set of capabilities that are adapted and are used in conjunction with other capabilities that may or may not involve other software.

Work System Life Cycle in an ERP Context

ERP is a cross functional intervention that affects multiple work systems. Since the work system life cycle model (WSLC) focuses on a particular work system, it is worthwhile to look at how that model applies specifically to ERP projects.

The main point is that the WSLC is not a model of an entire ERP project. An entire, corporate-level ERP project affects multiple work systems in order to achieve corporate-level goals such as efficient transaction processing, greater consistency, seamless availability of information, and smoother coordination. Various shortcomings related to the performance of multiple work systems lead to the initiation of the corporate ERP project, which installs ERP software that is used as part of the technical infrastructure for multiple work systems. The corporate project includes many subprojects at the work system level. A likely reason for failing to maximize business value from ERP in many cases is that those work system projects are never fully realized. Instead, the huge effort of simply getting the ERP running absorbs most of the available budget, time, and energy. The various work systems use ERP software, but many of them are not redesigned to benefit from ERP. Even if the conversion to using ERP software occurs and generates some of the expected benefits of consistency and data availability, many of the localized improvements that

could have occurred might never be analyzed or even considered. This paper's discussion of different design spaces provides guidance about where to look for that additional value.

In relation to individual work systems, the WSLC is pertinent to each of the work system improvement projects that might be included in a larger corporate ERP project, or that might be performed after the initial implementation of ERP. Here is how each phase of the WSLC looks in an ERP context:

Operation and maintenance is the ongoing operation of the work system after it has been implemented, plus small adjustments, corrections of flaws, and enhancements.

>>> In an ERP context, some of those adjustments and enhancements would be related to modifying ERP parameters and other ERP details. Other adjustments and enhancements would be related to any of the other elements of the work system, including training, incentives, process details, and so on.

Initiation is the process of defining the need for significant change in a work system and describing in general terms how the work system changes will meet the need.

>>> In an ERP context, the work system improvement project would be part of the initial ERP project, or, following the initial ERP implementation, could be a separate project that attempts to improve the performance of one or more work systems through additional changes that actually require a project.

Development is the process of defining and creating or obtaining the tools, documentation, procedures, facilities, and any other physical and informational resources needed before the desired changes can be implemented successfully in the organization.

>>> In an ERP context, the development phase for a new project related to work system improvement could involve any combination of the following: creating new training materials and documentation to replace whatever training materials and documentation were initially available, reconfiguring ERP parameters, creating customized add-ons to ERP, and using business intelligence or spreadsheet software to create software capabilities that are not linked directly to ERP software and that may or may not use ERP data and other data that is not in the ERP database.

Implementation is the process of making a new or modified system operational in the organization, including planning for the rollout, training work system participants, and converting from the old way of doing things to the new way.

>>> In an ERP context, this might involve new rounds of training and process change that were not fully addressed in the initial implementation.

Design Spaces for Improving Work Systems

The business value of ERP comes from a number of sources such as better rationalized and better documented business processes and transaction processing, consistent data definitions and formats, cross-functional data accessibility that improves internal coordination and communication, and use of industry standards that improve coordination and communication with external customers. Unfortunately, process choices expressed in ERP software do not encompass all conceivable possibilities for improving the performance of individual work systems whose local conditions and issues may not have been anticipated. Therefore it is possible to extend ERP value from each of those sources by looking more closely at the individual work systems that use ERP software and use or generate data in the ERP database. We will look briefly at five "design spaces" (Alter, 2010b), each of which organizes many ideas related to a particular theme that can be considered in the analysis, design, and evaluation of a work system.

Design Space #1: Possibilities for Change in a Work System

Systems analysis and design typically focuses on identifying and improving specific components, subsystems, or interactions of systems, both at aggregated and detailed levels. Table 2 (Alter, 2006b, 2010b) lists many types of changes that an analysis and design effort might consider. Some are in the spirit of engineering, such as adding, combining, or eliminating steps in a business process, or upgrading hardware and software. Others are more in the spirit of design, such as changing the nature of customer

relationships or the customer experience. This table or some other way of expressing typical possibilities for changes in work system elements or the work system as a whole could support analysis and design efforts through general knowledge, checklists, or even design tools.

Table 2. Design space identifying possibilities for changing components, subsystems, and interactions

Customers	Products & Services
• Add or eliminate customer groups. • Change customer expectations. • Change the nature of the customer relationship. • Change the customer experience.	• Change information content. • Change physical content. • Change service content. • Increase or decrease customization. • Change controllability or adaptability by the customer. • Change customer/ participant relationships • Provide different intangibles. • Change by-products.

Activities or Processes	
• Change roles and division of labor. • Improve processes and activities by adding, combining, or eliminating steps, changing sequences, or changing methods used within steps. • Change business rules and policies • Eliminate built-in obstacles and delays. • Add new functions not currently performed.	• Improve coordination between steps. • Improve decision making practices. • Improve communication practices. • Improve the processing of information (capture, transmission, retrieval, storage, manipulation, display) • Change practices related to physical things (creation, movement, storage, modification, usage, protection)

Participants	Information	Technologies
• Change the participants. • Provide training. • Provide resources needed for doing work. • Change incentives. • Change organizational structure. • Change the social relations within the work system. • Change the degree of interdependence in doing work. • Change the amount of pressure felt by participants. • Assure understanding of details of tasks and use of appropriate information and knowledge. • Assure that participants understand the meaning and significance of their work.	• Provide different information or codified knowledge. • Use different rules for coding information. • Codify currently uncodified information. • Eliminate some information. • Organize information so it can be used more effectively. • Improve information quality • Make it easier to manipulate information. • Make it easier to display information effectively. • Protect information more effectively. • Provide access to knowledgeable people.	• Upgrade software and/or hardware to a newer version. • Incorporate a new type of technology. • Reconfigure existing software and/or hardware. • Make technology easier to use. • Improve maintenance of software and/or hardware. • Improve uptime of software and/or hardware. • Reduce the cost of ownership of technology.

Infrastructure	• Make better use of human infrastructure. • Make better use of information infrastructure. • Make better use of technical infrastructure.
Environment	• Improve fit with organizational policies and procedures (related to confidentiality, privacy, working conditions, worker's rights, use of company resources, etc.). • Improve fit with organizational culture. • Respond to expectations and support from external stakeholders. • Improve fit with organizational politics. • Respond to competitive pressures. • Improve conformance to regulatory requirements and industry standards.
Strategies	• Improve alignment with the organization's strategy. • Change the work system's overall strategy. • Improve characteristics related to specific work system elements
Work System as a Whole	• Reduce imbalances between elements. • Improve problematic relationships with other work systems. • Conform to work system principles.

Design Space #2: Intentions Related to Work System Characteristics

Table 3 summarizes another design space by using work system elements (plus "work system as a whole") to organize design characteristics that are relevant to many work systems. Each characteristic in Table 3 (Alter, 2006b, 2010b) is a design variable that represents a big picture choice that might be considered before determining work system details, and that might be assessed on a numerical scale such as 1 to 5 to make a discussion a bit more concrete. Typical systems analysis and design texts for IS students say little about these design characteristics, and move quickly to technical documentation of processes and information. Design characteristics that are relevant to a specific work system might be used in searching for gaps between a work system's current and desired status in relation to important characteristics (e.g., Are decisions too structured or too unstructured? Are the activities too complex or too simple? Is the work too manual or too automated?) Important gaps would provide directions for changes that could be accomplished through many combinations of tactics in the design space in Table 2. The tactics in Table 2 and the characteristics in Table 3 are far from exhaustive, as becomes apparent when thinking about common types of subsystems of work systems (the next design space).

Table 3: Design space identifying characteristics for elements of a work system

Customers	Products & Services
• Customer segmentation • Treatment of customer priority • Nature of the customer experience • Style of interaction with the customer	• Mix of product and service • Product/service variability • Mix of information and physical things • Mix of commodity and customization • Controllability and adaptability by customer • Treatment of by-products

Major Activities or Processes	
• Degree of structure • Range of involvement • Level of integration • Complexity • Variety of work • Amount of automation	• Rhythm • Time pressure • Amount of interruption • Form of feedback and control • Error-proneness • Formality of exception handling

Participants	Information	Technologies
• Reliance on personal knowledge and skills • Personal autonomy • Personal challenge • Personal growth	• Quality assurance • Quality awareness • Ease of use • Security	• Range of functionality • Ease of use • Ease of technical support • Ease of maintenance

Infrastructure	• Reliance on human infrastructure • Reliance on information infrastructure • Reliance on technical infrastructure	
Environment	• Alignment with culture • Alignment with policies and procedures	
Strategies	• Fit with the organization's strategy • Fit with the strategy of related work systems	
Work System as a Whole	• Centralization/ decentralization • Capacity • Leanness • Scalability	• Resilience • Agility • Transparency

Design Space #3: Concepts Related to Generic Subsystem Types within a Work System

Additional hints about potential paths toward greater business value from ERP come from thinking about different types of subsystems that can be teased out of many work systems. Examples of common subsystem types include representation subsystems, information processing subsystems, informing

subsystems, decision subsystems, communication subsystems, social subsystems, and sensemaking subsystems. (Alter, 2010c). Identifying the various types of subsystems is potentially valuable because each type brings a set of metaphors, analytical concepts, design criteria, theories, and performance metrics that might be overlooked if the analysis of a work system focused primarily on documenting process steps and details of information. Given space limitations, this section provides brief comments about how the essence of typical subsystem types that may be useful in searching for business value of ERP. A separate unpublished manuscript identifies useful metaphors, theories, and criteria for each subsystem type.

Representation subsystems create representations of objects, phenomena, events, or other things of interest in a domain that is external to the subsystem. An example is an accounting information system that captures selected information about objects and events in the world, and then summarizes that information using the concepts and methods of accounting. Another type of representation subsystem is an explanation system that creates a causal representation of how and why a specific set of events occurred.

>>> ERP software provides a representation system for some of the information relevant to specific work systems. Much other relevant information is not represented within ERP. Use of spreadsheets or BI software in conjunction with ERP may enhance the reporting available through ERP capabilities. It is always possible, however, that that ERP by itself will never represent certain important data.

Information processing subsystems perform a combination of seven elementary information processing activities: capturing, transmitting, storing, deleting, retrieving, manipulating, and displaying information.

>>> ERP is designed to process certain information and ignore other information. Other complementary software might be used to set up localized information processing systems to collect other information and generate reports and analysis combining that information with ERP information.

Informing subsystem make information available to potential users of the information, ideally doing so in a way that makes the information truly usable. Informing includes standard reports and ad hoc reports.

>>> Business intelligence software and spreadsheets may provide additional informing capabilities that are not available from ERP.

Sensemaking subsystems contain processes and activities through which work system participants understand and interpret the work system's operation, performance, and context.

>>> ERP may provide information for the sensemaking system in which work system participants understand and interpret the situation. Other sources provide other sensemaking information.

Decision subsystems perform, support, or automate activities related to making decisions. Decision subsystems that use little or no technology include periodic meetings that discuss the assumptions, rationale, and actual or potential results of past or tentative decisions in order to make current or future decisions. Decisions subsystems that support decision-making include data- and model-based analysis efforts and analytical tools that support those efforts. Decision systems that automate decision-making receive inputs and use business rules, models, and other means to generate tentative or actual decisions.

>>> ERP may support decisions directly. A combination of ERP, BI, and other software may provide additional decision support that will probably have only occasional effect if it is not routinized.

Control subsystems use information to make sure that specific activities or processes achieve goals or operate in conformance with rules of behavior.

>>> ERP contains some types of controls but does not contain other types of controls. Programs written using other software might create additional control capabilities that are not available in ERP.

Communication systems convey information between people and/or machines. Communication between machines occurs through messages or other pre-specified forms of information transfer in which protocols for encoding, transmission, and decoding are completely specified. In contrast, communication between people involves a wide range of situations in which the information conveyed may be incomplete and unclear, the transmission of the message may be garbled, and reception and interpretation of the message may be incomplete, inaccurate, or biased.

>>> ERP might or might not be part of the communication subsystem within a work system.

Social systems are systems of creating and maintaining social relationships that are relevant to a work system's operation.

>>> ERP is not part of a social subsystem, although processes and agreements and conflicts related to ERP implementation and usage may have impacts on social subsystems.

Service subsystems perform work for the benefit of customers. Alter (2010e) explores some of the ways in which thinking of "systems as services" can provide insights related achieving greater business value. Some of those insights are related to the work system framework itself (because it puts the customer at the top). Other insights are related to a service value chain framework based on the coproduction of value by providers and customers, and/or based on examination of different paths for achieving "customer-centricity."

>>> Since work systems that use ERP can be viewed as service systems (Alter, 2010e), the service value chain framework and the ideas about customer centricity mentioned above might provide paths for achieving greater business value.

Design Space #4: Minimizing Risks and Removing Obstacles

Lists of common risks and obstacles can be organized using the format that is used in Tables 2 and 3. A sample table of this type is available at (Alter, 2006b, p. 66), but cannot be shown here due to this paper's length limitations. Using that type of information to minimize risks and bypass obstacles might help in generating greater business value from ERP.

Design Space #5: Minimizing Counterproductive Interactions between Work Systems

Regardless of how well an ERP-supported work system is constructed internally, direct and indirect interactions with other systems may be essential for a work system's successful operation or may cause that system's performance to degrade or even fail catastrophically. Alter (2010d) presents concepts and taxonomies for understanding, analyzing, and designing interactions between IT-reliant work systems. Types of interactions include direct control, joint control, precedence-based control, management oversight, auditing control, inadvertent interactions, accidental interactions, and implicit interactions. (Alter, 2010d, p. 3). Various types of persistent and transient misalignment and non-congruence between corresponding elements of interacting work systems (Alter, 2010d, pp 6-7) are another source of potential difficulties, and therefore another path toward increasing business value by eliminating problems. Once again, these tables are available but cannot be shown here due to this paper's length limitations.

Conclusion

This paper has presented a conceptual contribution to the discussion of attaining greater business value from ERP. By using components of WST to articulate aspects of what many experienced ERP practitioners and consultants do in practice, it encourages managers, business professionals, and IT professionals to emphasize work system performance and work system improvement when thinking about ERP in use and ERP projects. The basic premises listed at the outset represent a middle ground between assuming that ERP software dictates processes and activities that will happen in practice vs. focusing on local vocabulary, workarounds, and exceptions that often make the processes and terminology in ERP software problematic in practice. This paper explained how the two central frameworks of WST can be used to visualize work systems and work system projects in the context of ERP usage and ERP projects. It presented five design spaces that are probably not considered fully in most ERP projects, and that could provide insights that lead to greater business value, or at minimum that reduce risks, conflicts, and obstacles.

The idea of expanding the design space beyond a restricted focus on ERP per se is one of many possible approaches for achieving greater business value from the use of ERP. Another approach is to make greater use of competency centers or consultants, analysts, and super-users who can help with the ad hoc use of business intelligence software, spreadsheets, or other software, and who might be able to help in setting up computerized or non-computerized workarounds that bypass limitations of ERP software. (Eriksen et al.,

1999, El Amrani et al., 2010). The ideas presented in this paper might be used by those competency centers, consultants, and analysts just as they might be used by anyone else in the setting.

Several next steps could extend the design spaces and could demonstrate their usefulness in ERP contexts. First, it would be possible to review existing ERP case studies to see whether some of the main ideas in the design spaces were considered by the implementers and business managers, and whether the consideration or omission of those ideas had consequences for project outcomes. A more ambitious approach would involve explaining the ideas in more depth at the beginning of an ERP project or a work system improvement project in the context of ERP, and then tracking the project over time to see whether these ideas prove useful in finding paths toward greater business value.

ERP is a tremendously important type of software. ERP results to date have been mixed for a variety of reasons including difficulty in matching vendor software with local needs, differences in management capability and effort, situational contingencies, and the enormous amount of time, energy, and money that goes into these projects. The ideas in this paper might contribute to future success by helping managers and researchers visualize paths toward work system improvement that they might have overlooked otherwise.

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