

# Pervasive Real-Time IT as a Disruptive Technology for the IS Field

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## Abstract

*This paper builds on ideas in a recent paper which argued that the core subject matter of the IS field should not be “the IT artifact” (as suggested by Orlikowski and Iacono [1]), but rather IT-intensive work systems. This paper extends the ideas in the previous paper by exploring whether pervasive real time IT might be a disruptive technology [2] for the IS field, implying that the long term vibrancy and impact of the field depends on a change in focus and scope that emphasizes some version of work system concepts.*

*This paper defines the term “work system” and explains that information systems, projects, value chains, and supply chains are all special cases that should inherit work system terminology, generalizations, and success factors. It summarizes six real world examples to demonstrate different types of overlap between work systems and information systems that support them. Comparison of these systems shows that many of today’s more interesting information systems reflect a trend toward pervasive real time IT, i.e., increasingly commonplace application of IT to automate work practices or support and control them in real time. As this trend continues, the overlap between information systems and the work systems they support will increase, leading to a situation in which studying just the information system but not the work system it supports will have less and less significance. The paper concludes by arguing that the IS field needs to encompass work systems that do more than processing information. Expansion in this direction has implications for analyzing systems, conceptualizing system life cycles, communicating with business professionals, interpreting and performing research, and establishing different relationships with other academic fields such as organization behavior and operations management.*

## 1. Introduction

If its name is to be taken literally, the IS field is about information systems. By definition, the core subject matter of this field should emphasize how information systems operate, how information systems are built and maintained, and how information systems have positive and negative impacts in the world. By this definition the IS field should not delve into material systems (i.e., systems that create, transform, and move physical things) except when necessary to determine the requirements for an information system or to illustrate the impacts of an information system. Instead of asking whether people who consider themselves IS researchers actually live within these limitations, this paper initially ignores whether these restrictions are actual, imagined, or nonexistent and explores what it might mean for the IS field to move beyond the limits of its name. What if the IS field consciously recognizes that it has gradually outgrown its old skin and is ready to encompass a larger, more inclusive body of concerns and knowledge? How could that body of knowledge be described and what would be some of the likely steps in that direction?

The title and subject matter of a brief case presented in *Harvard Business Review* illustrate issues that this paper will explore. The case was called “The IT System that Couldn’t Deliver”[3]. The story concerned an attempt to provide laptop computers to insurance salespeople, thereby enabling 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 had started similar initiatives, and the desired market advantage had not materialized. 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 illuminates a central issue about the IS field. 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 had not generated the necessary urgency and involvement in the sales force. The details of the design and development efforts were not explained thoroughly, but the real issues in the case 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 had not delivered 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 processes involving much more than steps using 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]

This paper argues that the increasingly commonplace application of IT to automate work practices or support and control them in real time is beginning to require that the IS field shed its current skin and embrace a broader concept such as “work system” as its core. It extends ideas in a recent working paper [5] which argued that the core subject matter of the IS field should not be “the IT artifact” as suggested by Orlikowski and Iacono [1], but rather IT-intensive work systems. The next section defines the term “work system” and explains that information systems, projects, value chains, and supply chains are all special cases that should inherit work system terminology, generalizations, and success factors. The subsequent section summarizes six real world examples to demonstrate different types of overlap between work systems and information systems that support them. Comparisons of these systems illustrates why many of today’s more interesting information systems reflect a trend toward pervasive real time IT. The paper concludes by arguing that the IS field should expand to encompass work systems that do things other

than processing information. Expansion in this direction has implications for analyzing systems, conceptualizing system life cycles, communicating with business professionals, interpreting and performing research, and establishing different relationships with other academic fields such as organization behavior and operations management.

## 2. Work Systems and Information Systems

A set of ideas about work systems has emerged from an ongoing effort to develop an organized, reasonably rigorous method that business and IT professionals can use for understanding and analyzing systems in organizations whether or not IT plays an essential role. Still in development, the “work system method” is designed to be more broadly applicable than techniques for specifying detailed software requirements and more prescriptive and powerful than domain-independent systems analysis methods. Its evolution over the last decade stemmed from previous experience in the manufacturing software firm Consilium, some of whose customers and staff might have benefited from an organized method for exploring the relationship between software features and work practices. [6]

The importance of thinking about work systems became apparent after a number of years of using student papers on real world information systems as a test of successive iterations of a questionnaire for thinking about systems from a business viewpoint. Around 1997, I realized that I, the professor, had been confused about what system the students should be analyzing. Business professionals (as exemplified by these employed MBA and EMBA students) thinking about information systems should *not* start by describing or analyzing the information system. Instead, they should start by describing the work system and identifying its shortcomings, opportunities, and goals for improvement. Their analysis should focus on improving work system performance, not on fixing information systems. The necessary changes in the information system would emerge from the analysis, as would other work system changes unrelated to the information system but often necessary before information system improvements could succeed. In 2000 and 2001, I discovered through Web searches that socio-technical researchers had sometimes used the term *work system* several decades earlier, although in the late 1990s the term seemed to be used only rarely in academia or in real world practice, and might refer to anything from a business process to an entire organization and its culture. [6, footnote on p. 318] The following section defines work system and work system life cycle in a particular way that makes work system concepts useful for analyzing the operation and evolution of systems in organizations.

## The Work System Framework

A work system is a system in which human participants and/or machines perform business processes using information, technologies, and other resources to produce products and/or services for internal or external customers. [7] Typical business organizations have work systems for functions such as obtaining materials from suppliers, producing and delivering end products, finding customers, creating financial reports, hiring employees, and coordinating work across departments.

Figure 1 is a graphical representation of a framework that can be used to summarize any work system and to serve as a focal point for analyzing a work system. ([8], as updated in [9] and [10]) Each element in the framework should be included in even a superficial understanding of a specific system. The arrows between various elements reflect the importance of maintaining mutual alignment between these elements. The trapezoid surrounding the business process, participants, information, and technology in Figure 1 indicates that those four elements constitute the system performing the work. The work system's outputs are the products and services received and used by its customers. Consideration of products, services, and customers even though they are not part of the system reflects the notion that a work system exists to produce things customers want. Environment and infrastructure are usually key determinants of whether a work system can operate as intended and can accomplish its goals. Strategies of the work system and organization may not be well articulated, but sometimes help in explaining why the work system operates as it does.

**Business processes.** The work performed within the work system can be summarized as one or more business processes whose steps may be defined tightly or may be relatively unstructured. Activities within each step may combine information processing, communication, sense making, decision making, thinking, and physical actions. As workplace researchers point out repeatedly, the actual operation of business processes often deviates from the idealized business processes that were originally designed or imagined. In addition, different participants may perform the same steps differently based on differences in skills, training, and incentives.

**Participants.** People who perform the work in the business processes are work system participants. Some may use computers and IT extensively, whereas others may use little or no technology. Whether or not particular participants happen to be technology users, when analyzing a work system the more encompassing role of participant is more important than the more limited role of technology user.

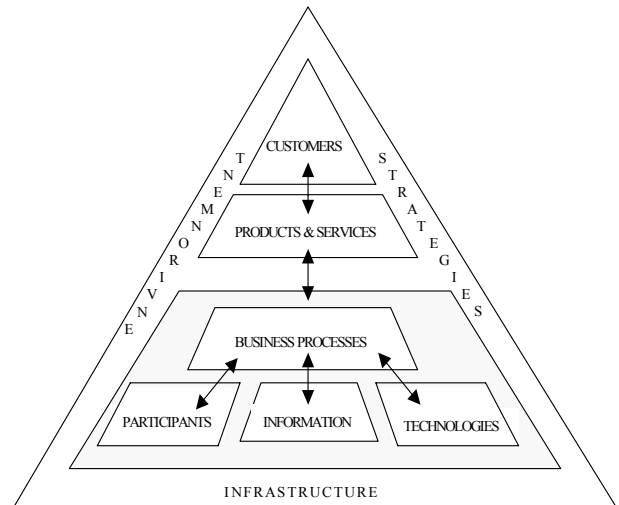


Figure 1: The Work System Framework

**Information.** Information includes codified and noncodified information used and created as participants perform their work. Information may or may not be computerized. Data not related to the work system is not directly relevant, making the distinction between data and information secondary when describing or analyzing a work system.

**Technologies.** Technologies include tools (such as cell phones, projectors, spreadsheet software, and automobiles) and techniques (such as management by objectives, optimization, and remote tracking) that work system participants use while doing their work. Even when substantially computerized, specific tools (such as cars) and techniques (such as use of checklists) may or may not be associated with IT in a particular situation. In terms of the framework, technologies are integral parts of the work system and their affordances (such as a cell phone affording mobility) are evident to system participants. In contrast, technical infrastructure includes computer networks, programming languages, and other technologies shared by other work systems and often hidden or invisible to work system participants.

**Customers.** People who receive direct benefit from products and services the work system produces include external customers who receive the organization's products and/or services and internal customers who are employees or contractors working inside the organization. According to TQM, a work system's customers are typically best able to evaluate its products and services. Customer satisfaction is often linked to the entire customer experience, starting from determining requirements and acquiring the products or services.

**Products & services.** Products and services are the combination of physical things, information, and services that the work system produces. They may include physical products, information products, services, intangibles such as enjoyment and peace of mind, and social products such as arrangements, agreements, and organizations. The terms products and services are used instead of “outputs” because that term brings too many mechanistic and computer-related connotations, especially when services and intangibles are involved.

**Environment.** Environment includes the organizational, cultural, competitive, technical, and regulatory environment within which the work system operates. These factors affect system performance even though the system does not rely on them directly in order to operate. The organization’s general norms of behavior are part of its culture, whereas more specific behavioral norms and expectations about specific activities would typically be considered part of the business process.

**Infrastructure.** Infrastructure includes human, informational, and technical resources that the work system relies on even though these resources exist and are managed outside of it and are shared with other work systems. Infrastructure includes support and training staff, shared databases, telecommunications networks, programming technology, and the Internet.

**Strategies.** If they are articulated, the work system’s and the organization’s strategies may help in explaining why the work system operates as it does. Examples of work system strategies include assembly line versus case-manager and mass customization versus commodity or manual customization.

### ***Work System Life Cycle Model***

Work systems exist in a particular form during a particular time interval. Changes in the work system’s state may occur during that interval without significantly changing the work system’s form. The work system life cycle (WSLC) model in Figure 2 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, incremental adaptations lead to further adaptations usually accomplished without major projects or major allocation of resources.

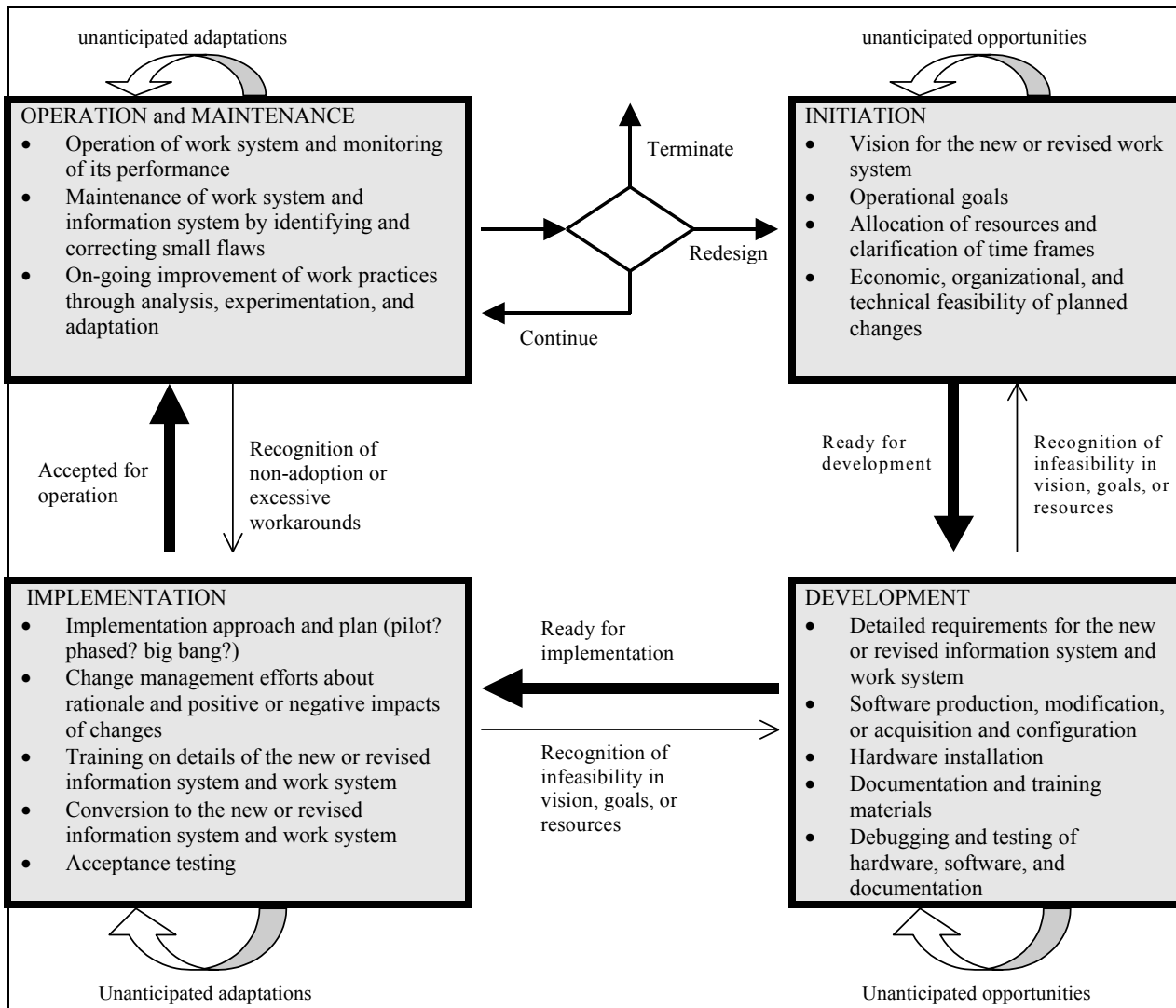
The first version of the WSLC model appeared in the first edition of my textbook and was designed as a

common denominator for custom development, use of application packages, prototyping, end user computing, and other ways to build information systems. The names of the phases were chosen to apply to non-computerized systems as well. An extended version added iterations; [11] demonstrated its generality by showing how the extended version encompassed over a dozen models in the IS literature. An additional revision in Figure 2 [9] adds explicit recognition of unanticipated opportunities and unanticipated adaptations, thereby recognizing the importance of diffusion of innovation, experimentation, adaptation, emergent change, path dependence, windows of opportunity, and assimilation gaps. (e.g., [12,13,14, 15,16]) Inclusion of these factors is at least partly inconsistent with project-oriented viewpoints, which often seem to treat unanticipated opportunities and adaptations as problems rather than opportunities and categorize them under pejorative headings such as “requirements creep” and nonconformance.

### ***Information Systems as a Special Case***

Information systems constitute a special case of work systems. They are work systems in their own right since they consist of human participants and/or machines performing business processes using information, technologies, and other resources to produce products and/or services for internal or external customers. Information systems are a special case of work systems because the business processes they use and the products and services they produce are devoted to information. The business processes involve some combination of six types of activities: capturing, transmitting, storing, retrieving, manipulating, and displaying information. These activities may be done using computers or networks, or using manual technologies such as pencil and paper. Examples of information systems include tracking systems used by package delivery companies, medical reimbursement systems used by insurance companies and governments, and architectural design systems used by architecture firms. In addition to just processing information (with or without the help of IT), the participants in each of these information systems may perform other activities including communication, sense making, decision making, thinking, and physical actions. The distinguishing characteristic of information systems is that their business processes are mostly or entirely about information and the products and services produced consist of information.

As special cases of work systems, information systems and other special cases such as projects, value chains, and supply chains inherit vocabulary, analysis methods, and success factors that apply to work systems in general. Similarly, special types of information systems and projects probably inherit concepts related to



**Figure 2: The Work System Life Cycle Model**

information systems and projects in general. The idea of inheritance is potentially useful for codifying knowledge about work systems and all of the special cases because system elements, characteristics, performance variables, and related phenomena, propositions, and generalizations associated with a more general case (a supertype) should also apply to relatively similar subtypes. [17]

***Overlap between Information Systems and Work Systems They Support***

In addition to being work systems in their own right, information systems typically exist to produce products and services used by other work systems that may or may not be information systems. The distinction between

an information system and the work systems it serves is important because there are many possible relationships and forms of overlap between the information system (IS) and the work system (WS). These include [18]

- Comparatively small IS provides information for a WS but is not part of it. Example: An IS that collects production data and creates a file of production data used by the accounting department in its work system for closing the books.
- Comparatively small IS is a dedicated component of a WS. Example: A real time dispatching system that helps manufacturing workers decide which lot to process next in a factory.
- WS is primarily devoted to processing information and the IS and WS are almost identical. Examples:

billing system, payroll system, loan approval system.

- One IS overlaps with several separate WSs. Example: An IS for sales call tracking might be used by the sales force for tracking sales progress and by the finance department for financial projections.
- A large IS supports a number of different WSs and might be larger than any of them. Example: An airline reservation system used for deciding what flights to take, booking reservations, making yield management decisions about how much to overbook flights, analyzing frequent flyer promotions, etc.

How one would design either an information system or a work system it supports would depend on the degree of overlap between the two systems. For example, if a work system is largely an information system, the design of the work system would largely be an information system design effort. On the other hand, the separate design of a work system and a related information system whose business processes overlap minimally or not at all might be more meaningful.

### 3. Real World Examples

Instead of speculating about the advantages of using work system concepts rather than information system concepts as a primary lens, six real- world work system examples will be presented that were selected to illustrate a realistic range of different situations encountered by information system practitioners. (See Table 1) Using six examples instead of none or one or two is a way to avoid forming generalizations about the field based on ungrounded abstractions or a few similar examples that represent only a small subset of the field. Obviously many other examples could be cited if space permitted. The first three examples are work systems whose essence involves physical work even though information processing and communication play important roles. The other three examples are work systems whose essence involves information processing along with decision making and communication.

Table 2 summarizes a number of important characteristics of these selected work systems. It shows that an information system is very important for five of the six work systems. In other words, the examples were not chosen to minimize the importance of the information system. In addition, the work systems were chosen for diversity across other characteristics:

- Three of the work systems are primarily material systems and three are essentially or entirely information systems.
- The work in these systems ranges from highly structured to unstructured.

- The social aspects of work range from none (for the e-commerce Web site) through somewhat important (for equipment loans and semiconductor manufacturing) through very important (for coordinating and maintaining a global virtual team).
- All of the systems involve communication, but the nature of the work for three of the systems is about performing physical tasks. In two cases most of the communication is between people and tools rather than interpersonal. In one case, the purpose of the work system is to foster communication.

Table 3 shows that five of the six work systems contain at least part of an information system and that all of the work systems include some activities that are outside of any information system that might be present. Where does this leave us regarding the boundaries of the IS field? For material systems, talking about the information system without talking about the work system automatically omits questions about whether the information system really helps and whether it might be more effective if it were integrated with the work system in a different way. In the cases where the information system and the work system overlap significantly or are almost identical, the same question remains. Unless one is purely interested in how an information system operates on a computer or how it operates on a computer plus how users interact with it, declaring that one is only interested in the information system is somewhere between unnecessarily limiting and simply sterile.

### 4. Pervasive Real Time IT as a Disruptive Technology

Pervasive real time IT is the increasingly commonplace application of IT to automate work practices or support and control them in real time. It is a disruptive technology for the IS field because it implies the increasing integration of information systems into the operation of work systems they support. Remove the information system and the work system cannot operate properly. Remove the work system and the information system has little meaning or purpose.

Although none of the foregoing examples currently represents pervasive real time IT, the trend in that direction is present in all but the first. For instance, express delivery of packages can occur without extensive tracking, but effective tracking and online access to tracking data requires technology that was not cost effective 20 years ago. Five or ten years in the future, the tracking may occur through an RFID chip embedded in the package or through some other means that makes tracking less visible but more effective. The trend toward pervasive real time IT also applies, but in different forms, for chip manufacturing, loan approvals, Web-based purchasing, and maintaining global virtual teams.

**Table 1: Six Work Systems and Their Business Processes**

<i>Summary of the work system</i>	<i>Summary of the work system's business processes</i>
<b>Moving pianos.</b> A firm is in the business of moving pianos. Although communication is certainly important in accepting orders and in successfully dealing with the uncertainties and difficulties of moving pianos, the essence of this company's main work system involves physical work rather than speech acts or information processing.	Drive to location of piano; contact responsible person on site; determine best route to the truck; disassemble piano for movement; move piano to truck; drive truck to new location; determine best route from the truck; install piano in new location.
<b>Express delivery of packages.</b> FedEx, UPS, and other package delivery companies rely heavily on using bar codes to track packages through checkpoints on the path from sender to recipient. Customers can use the Web or phone a customer service center to learn the package's location. Although these information systems have attained great competitive significance in this industry, the essence of this work involves physical activities that occurred for centuries before computers were invented.	Pick up package from sender or mailbox; log package into tracking system; physically move the package using trucks, airplanes, and conveyors within distribution centers; use bar codes to track package through each node; deliver package to recipient, consistent drop-off instructions.
<b>Manufacturing semiconductor chips.</b> Semiconductor manufacturers perform technically complex physical work at the cutting edge of what is possible with today's technology. These processes cannot succeed without the extensive use of information systems that track wafers through each step; collect yields, cycle times, and engineering parameters; provide planning, dispatching, and control information to technicians and managers; and directly control some automated steps. Communication and negotiation are often important because technicians and process and product engineers play active roles in monitoring and adjusting manufacturing process. This entire process became more automated in recent decades as the tolerances and line widths in the chips shrank.	Starting from a pure silicon wafer, perform a 100-200 step process that defines circuit functions through various iterations of using photolithography to create patterns on the surface of the wafers and using ovens, ion implanters, etchers, and other equipment to change physical properties of particular parts of each chip. Send finished wafers to downstream processes for separating and testing chips, inserting in packages, and performing final tests.
<b>Approving equipment loans.</b> An example in Hammer and Champy's influential book on reengineering [19] involved IBM Credit's work system for approving equipment loans to IBM's customers. Prior to reengineering, this work system was organized as an assembly line, with a week or more consumed as different people performed different steps. After reengineering, the work system operated through a case manager approach in which a single individual receives the application, makes major decisions, and returns the results to the salesperson, often the same day that the application is received.	<i>Before</i> reengineering: use an assembly line process with many participants performing separate steps: receive and log applications; determine interest rate and other loan provisions; check applicant's credit rating; produce text of loan document; print loan document; mail to applicant and salesperson. <i>After</i> reengineering: similar steps performed by a single "case manager" who executes the entire process using an information system providing procedural support, data, and models.
<b>Purchasing an airline ticket using a Web site.</b> A customer purchasing a ticket through a Web site uses a database of flight times and prices to select an itinerary and purchase tickets. With electronic tickets and email confirmation, no physical artifacts need be produced. This system replaces the previous system in which the buyer spoke to human reservation agent who accessed the database. The customer experience with the new system is quite different.	Customer logs on to the Web site; customer requests a list of future flights that meet criteria for dates, times, and airlines; server retrieves desired information and displays to customer; customer selects itinerary or submits revised flight parameters; either customer gives up or customer purchases the ticket.
<b>Coordinating and maintaining a global virtual team.</b> As described in [20], global virtual teams require ongoing communication for coordination, for dealing with unexpected issues, and simply for maintaining relationships between the dispersed team members. The business process is between unstructured and semistructured, but an important finding involves the importance of maintaining a rhythm of communication between distributed team members, in effect a work system for maintaining a global virtual team.	Use telecommunications technology to hold periodic meetings for both coordination and maintenance of the distributed teams.

**Table 2: Important Characteristics of Six Work Systems Described in Table 1**

===== <i>Characteristic</i>	<i>Piano moving</i> =====	<i>Package delivery</i> =====	<i>Semiconductor Manufacturing</i> =====	<i>Loan approval</i> =====	<i>Using the Web to buy airline tickets</i> =====	<i>Team maintenance</i> =====
<i>Importance of the information system</i>	Minor	Important for doing work and for competition	Essential for effective manufacturing	Essential for new process	Essential for Web-based buying	Essential for global virtual team
<i>Degree of WS/IS overlap</i>	Mostly a material system, not an IS	Mostly a material system, not an IS	Mostly a material system, not an IS	Mostly an IS	Mostly an IS	Mostly an IS
<i>Extent to which the work is structured</i>	Semi-structured	Highly structured	Highly structured process with some tweaks	Semi-structured	Semi-structured. Search; Structured purchasing	Unstructured or semi-structured process
<i>Extent to which the work is social</i>	Some social aspects for cooperation	People involved, but delivery is physical	Important social relations for cooperation	Small social component with both approaches	Not social. The buyer is simply using a Web site.	Highly social. Main purpose is social
<i>Significance of communication in the work</i>	Necessary, but the work is about moving pianos	Necessary, but the work is about delivery	Necessary, but the work is about creating circuits	Necessary, but the work is about making decisions	Necessary, but not interpersonal (Web usage)	Purpose is interpersonal communication

**Table 3: Overlap and Non-Overlap between Each Work System in Table 1 and the Related Information Systems**

<i>Work system</i>	<i>Major activities (in the work system) that can be viewed as part of an information system</i>	<i>Aspects of work system that are outside of information systems</i>
Moving pianos	· None (Some activities involve information, but not enough to say that an information system is involved.)	· Physically moving the pianos
Express delivery of packages	· Using bar codes to register each package and collect information as each package passes each tracking point. · Making information available for customer service and management.	· Physically picking up the packages, moving them to the destination, and delivering them to the recipient
Manufacturing semiconductor chips	· Collecting information as each lot moves through each step in the manufacturing process. · Making information available to technicians, engineers, and management.	· Performing complex manufacturing operations using complex technologies. · Moving work-in-process and materials between machines and holding areas.
Approving equipment loans	· Processing the loan request and information about the customer · Accessing computerized information and models · Producing the loan document.	· Identifying anomalies or problems in the application via knowledge and intuition · Making non-automated decisions using computerized information and judgments.
Purchasing an airline ticket using a Web site	· User specifies or revises needs or requirements · Web site identifies, prioritizes, and displays relevant options. · Buyer purchases the ticket	· Buyer determines needs or requirements. · Buyer evaluates the relative merits of the options presented by the Web site.
Maintaining a global virtual team	· IT-mediated meetings of geographically dispersed team members.	· Personal contacts and communications outside of the meetings.

As the pervasiveness of IT and the real time nature of its applications increases, efforts to study information systems without studying the work systems they support is increasingly like studying the skeleton or the nervous system without paying attention to the rest of the body. For both information systems and biological entities, studying the parts in isolation has numerous benefits for some topics, but the resulting knowledge cannot be fully exploited and often cannot be communicated effectively without looking at the larger system. Why would anyone *choose* to define a field in a way that defeats part of its ultimate purpose, especially when a plausible alternative is available?

***What if the IS Field Treated Work Systems as a Core Concept?***

Assume that the IS field were expanded and henceforth would treat information systems, projects, value chains, supply chains, and ecommerce web sites as special cases of work systems. Immediate implications include:

- Basing system-related terminology in work system ideas would make it more understandable and less formidable to typical business people. This would improve communication about systems and system-related projects.
- The work system would become the natural unit of analysis. The work system would be the system being analyzed rather than the customer of the system being analyzed. In a biological parallel, this would be more like treating legs as though they contained part of the circulatory system rather than treating them as though they were customers of the circulatory system. Both views can be useful, but the

second creates an artificial separation that might discourage consideration of many important issues about circulation.

- The intertwined nature of information system success and work system success would become more obvious. Yes it will always be possible to measure whether an information system is operating consistent with its technical design specs, but the key business issue is work system success.
- The work system life cycle would be the basic life cycle model, and the system development life cycle model would be seen as a project model rather than a model of how systems evolve over time.
- The use of inheritance would make it easier to organize concepts and codify IS knowledge. It would become apparent that many success factors found in empirical IS research (such as management support, adequate resources, commitment by participants) are success factors for work systems.
- Techno-hype would become more apparent and easier to penetrate. When confronted with assertions using acronyms such as CRM, ERP, and TQM and terms such as integrated, global, quality, intelligent, reengineered, e-business, and virtual organization, the question “exactly what work system are you talking about?” would help in understanding whether the assertion concerned a software product, a software category, a type of system, or a particular work situation that is being viewed in system terms.

## ***Impact on Research***

The first surge in the trend toward pervasive real time IT created the computerized information systems that most important work systems in today's organizations rely on. These important work systems typically combine activities that may or may not involve processing information and may or may not be supported by IT. The research included under the umbrella of IS already focuses on these systems, as exemplified by the comparative prominence of supply chain and value chain examples in the IS literature even though much more than processing information is involved. For future IS research to have maximum value and long-term impact, that research should recognize explicitly that it should or already does encompass aspects of work systems that do not involve IT directly (as anyone involved in an implementation or reengineering project surely realizes).

Adopting a work system viewpoint for research might be easier said than done, however. In "Desperately Seeking the 'IT' in IT Research - A Call to Theorizing the IT Artifact," Orlikowski and Iacono [1] reviewed ten years of the journal *Information Systems Research* and concluded, "the field has not deeply engaged its core subject matter - the IT artifact." They classified of 177 articles into subcategories of five major clusters (nominal view - technology absent; computational view, tool view, proxy view, and ensemble view). Only 12% of the articles applied the ensemble view, which focused on "dynamic interactions between people and technology, whether during construction, implementation, or use in organizations, or during the deployment of technology in society at large." The fact that only 12% applied the view most akin to a work system view might imply that IS researchers are not as interested in that view or that it is especially difficult to do effective research and write articles about inherently multidisciplinary topics with enough depth and sophistication to qualify for a top-rated journal.

Regardless of why research topics were chosen in the past, the trend toward pervasive real time IT increases the importance of research that looks directly at IT-intensive systems in organizations, and not just at related disciplines, individual components, or aggregate measures such as industry profitability. Furthermore, if we could re-run the many discussions of rigor versus relevance of IS research (e.g. [21, 22, 23]) it is doubtful that any would conclude on the basis of relevance that future researchers should hunker down and focus more strictly on the information system portion of IT-intensive work systems because that "how the field is defined" or what its focus was in the past. Treating work systems as a core concept in the IS field might improve its mix of

rigor and relevance by providing rigorous concepts that can support rigorous research about situations and topics with a genuine impact on practice.

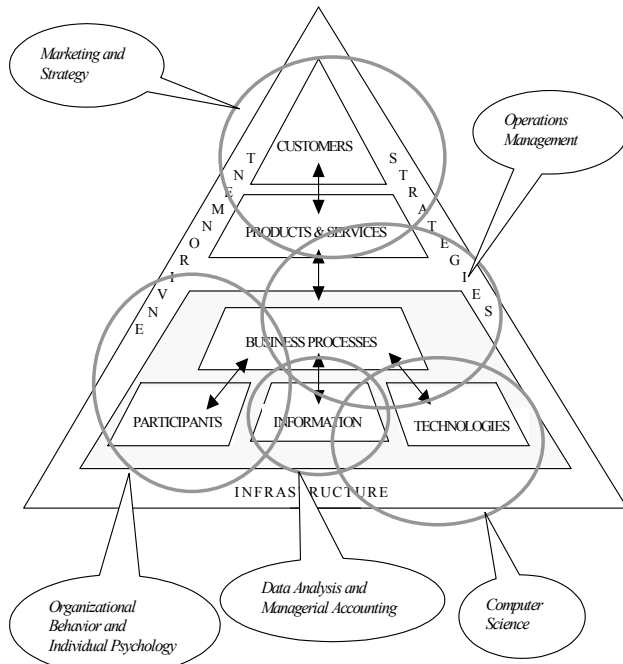
## ***Effect on Overlaps with Other Academic Fields***

Figure 3 shows that most of the elements of a work system are associated with established disciplines that provide relevant concepts and research findings. If IS began to look at work systems as a core concept, it would almost certainly absorb some of the good ideas from the other fields. This might lead to questions about who owns which academic turf and whether the somewhat permeable boundaries between academic silos should become harder or softer.

Figure 3 also raises the question of whether the IS field has contributed or has the potential to contribute knowledge not provided by the related disciplines. Referring to articles about e-business, Benbasat [24] argued that "as members of the IS field" [we need to] "highlight our unique contributions to the understanding of e-business." ...[and] "distinguish our work from that of other colleagues in other disciplines, e.g., those in marketing or supply chain management who are studying the same phenomena." Even if one accepts the argument by Baskerville and Myers [25] that IS field has contributed to other disciplines, it is worthwhile to ask what aspect of the IS field most directly shapes those contributions. In my opinion, the unique contributions of the IS field are probably related to the system-related treatment of activities that cannot be described satisfactorily with non-system concepts from the other fields. If the unique contribution of the IS field is related to the "system nature" of its subject matter, starting from work system viewpoint rather than the more limited information system viewpoint is likely to provide a richer set of ideas that might describe reality more meaningfully and might produce research findings of greater potential value.

There is a legitimate question about how every one of the fields in Figure 3 should evolve over the next several decades and whether the existing boundaries should remain in place. In general, that evolution should be determined largely by the interplay of the needs of society and business, the inertia of the current situation within academia, and the disruptive forces in the environment.

In terms of the evolution of the IS field, the needs of society and business are apparent in the appalling rates of failure and disappointment in IT applications. Imagine what would happen if the construction industry produced



**Figure 3: Disciplines Dealing with Various Work System Elements**

such a large percentage of edifices that are never finished or that never satisfy their original goals even if they do achieve operational status. As with the *HBR* case mentioned at the outset, many of the failures and disappointments are not about the information system per se, but rather, about whether the information system fits the work system and whether the desired work system is ultimately implemented. The needs of business and society call for expanding the scope of the field to include the operation and evolution of work systems, whether or not IT happens to be involved.

Pushing in the opposite direction, the inertia of academia might keep the current disciplinary distinctions alive for a while, but even slow-moving academia has to deal with the disconnect between existing academic concerns and issues of reality. As it becomes less and less interesting for business professionals and business students to focus on just the information system in examples such as the six mentioned earlier, it will become more difficult to main the stance that information systems are the right unit of analysis, either for teaching or for research.

**Conclusion: Does the Banner We March Under Really Matter?**

My business card says I am a professor of information systems, but my information system core course covers the broader topic of how business professionals can understand and analyze systems in organizations. On the other hand, most of my colleagues consider me a professor of MIS, which is only a small subset of the field. Whether or not my business card should say IS or MIS doesn't matter very much, but it does matter that much of the IS field's jargon reflects hype, sets excessive expectations, and is often just confusing. I think it is a bit of a problem that:

- customer relationship management (CRM) is not really about relationships;
- enterprise resource planning (ERP) is more about transaction processing than planning;
- expert systems do not operate like experts;
- total quality management (TQM) is anything but total when it focuses on just certain structured processes;
- *implementation* may mean making an algorithm run on a computer or adopting a new way to do a particular type of work in an organization, depending on who is speaking;
- *system* may mean a software suite or a hardware device or an information system or a work system, depending on who is speaking.

Yes, we certainly manage even with such confusion, and yes, it would be fruitless to try to create the terminology police. However, the name and core subject matter of a field does create an expectation about which topics and issues are included and which are beyond the scope and in someone else's territory. The problem in drawing a tight boundary around information systems is that much of the juice and meaning is on the other side. We should redraw the boundary to include all work systems, even if that means the field's name should change to *systems in organizations*, *work systems*, or something else that better describes the sweet spot where the field can have the maximum impact.

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