EMPOWERING BUSINESS PROFESSIONALS THROUGH A SYSTEMS ANALYSIS METHOD THAT FITS THEIR NEEDS

SYSTEMS ANALYSIS FOR EVERYONE ELSE: EMPOWERING BUSINESS PROFESSIONALS THROUGH A SYSTEMS ANALYSIS METHOD THAT FITS THEIR NEEDS

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Abstract

Fundamental difficulties in understanding and communicating about IT-reliant systems contribute to longstanding problems with project management, user participation, specification of requirements, implementation in organizations, business/IT alignment, and IS failures. Those issues persist despite having been explored, described, theorized, and measured in hundreds of IS research articles.

The paper reports on a design science research project demonstrating a possible path toward addressing these longstanding problems by empowering business professionals to analyze systems in business terms, and not in UML, BPMN, or other formalisms that were developed for IT specialists. In this research, 75 working business professionals with extensive business experience used the latest iteration of a work system analysis template to analyze IT-reliant work systems in their own work sites, and recommend improvements. Unlike earlier work system research at the original developer's university, the current research occurred in conjunction with three MBA programs at a major east coast university in the United States. Analysis of 75 submissions confirmed that participants could use the work system analysis template effectively. As expected in design science research, the analysis of the submissions led to recommendations for improving the design artefact.

Keywords: systems analysis, user participation, requirements specification, implementation, work system method

1 THE NEED TO EMPOWER BUSINESS PROFESSIONALS

The level and quality of user participation in system development and maintenance is often inadequate despite widespread agreement about its importance. Users often have difficulty saying what they want. Even if the software totally reflects what they requested, it often omits important capabilities that they failed to request. (For example, see Markus and Mao (2004) and related papers for extensive discussions and numerous references that will not be repeated here due to length limitations.)

The lack of effective analysis methods that can be embraced fully by business professionals is a significant part of the user involvement problem. Typical systems analysis methods and tools such as diagramming tools, UML, and BPMN are designed for use by IT specialists. There is a growing literature about limitations in these tools and their use (e.g., Dobing and Parsons (2006), Siau et al. 2005)). The relatively rare ability of some IT analysts to engage with business professionals while using these tools in no way implies that existing analysis and documentation methods for IT professionals fully address difficulties in collaboration between most business and IT professionals.

 Part of the problem is that business professionals are at a disadvantage when IT professionals use their own methods and tools to frame the conversation, the problem, and the solution. (Beath and Orlikowski (1994), To participate on equal footing, business professionals should have methods and tools that they can use for thinking about IT-reliant systems with or without the help of IT specialists.

We report on a step toward empowering business professionals by providing systems analysis methods and tools designed for their need to think about IT-reliant work systems in an organized way. We designed and tested a new version of a systems analysis method that has been developed over many years. The immediate goals of the research were to determine whether business professionals are able to use this approach effectively and to use the results as feedback for improving the tool.

Organization. We provide background about the development of the work system approach and explain how that research and the current extension fit into a design science research paradigm.. The research setting is a natural field setting involving the use of a new work system analysis template by 75 employed MBA student participants, most with substantial business experience, in order to analyse systems in their places of work. We discuss the work system analysis template that was used (the design artefact), and the range of situations that were analysed. As a specific example of the results, we show part of one participant's analysis. We mention a number of difficulties encountered in using the design artefact. Consistent with guidelines for performing design science research, we identify improvements to the design artefact and hence, to the work system method, which was designed for application at different levels of detail depending on the user's role in the organization.

2 DESIGN SCIENCE APPROACH FOR DEVELOPING A METHOD AND TOOL FOR BUSINESS PROFESSIONALS

Extension of previous design science research. Over more than a decade, Alter (1995, 1999, 2003, 2008a, 2008b) addressed various aspects of the above problems by developing 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 anticipated tenets of design science research that were articulated in *MIS Quarterly* by Hevner et al (2004), such as relevance, basis in theory, testing, evaluation, and iterative improvement. Alter believed that the problem was relevant based on experience in a manufacturing software firm and based on agreement among his Executive MBA students that very few of their firms had organized analysis methods for thinking about systems and system improvement; the core of his approach was a type of theory that Gregor (2006) described later in *MIS Quarterly* as a "theory for understanding."

The work system approach assumes that the topic of analysis is a work system, a system in which human participants and/or machines perform processes and activities using information and

technology to produce products and services for internal and/or external customers. Almost all current work systems are IT-reliant. They rely on IT but are not IT systems. A work system's goal is to provide value for its customers, not just to operate consistent with its own specifications. Requirements are assumed to evolve over time. Information systems are special cases of work systems in which all of the processes and activities are devoted to processing information. Other special cases of work systems include supply chains, ecommerce systems, and projects. Work system modeling can be used to describe situations ranging from the work of filling out simple computerized forms through the complex work of producing airplanes. Its area of usefulness is between the two extremes.

Emphasizing business viewpoints and issues. Explanations of systems analysis and design methods in typical textbooks for IS students assume "the system" being designed is a technical artefact, rather than a sociotechnical system, and that business analysis is someone else's problem. For example, in a summary of the design phase of the SDLC, Hoffer et al. (2008, p. 13) says "analysts must design all aspects of the system, from input and output screens to reports, databases, and computer processes." Similar statements appear in Kendall and Kendall (2008, p. 13), Dennis et al. (2002, p. 7), and Mathiassen et al. (2000, p. 7).

In contrast, methods and tools that emphasize business viewpoints and issues should view the system as a sociotechnical system and should focus on how to improve that system's performance. That focus expresses much more of a business emphasis than focusing on software development or IT usage. The latter are important IS research topics, but are not the central topics for analysis of business situations by business professionals, MBA students, or even IT professionals who are genuinely concerned with improving organizational performance. A work system approach recognizes the importance of appropriate tools for IT professionals, but focuses on how and how well people and/or machines produce products and services for internal or external customers in specific situations.

The two central frameworks in work system theory are the work system framework and work system life cycle model. The work system framework identifies nine elements that are part of even a rudimentary understanding of a work system: customers, products and services, processes and activities, participants, information, technologies, environment, infrastructure, and strategies. The work system life cycle model is an iterative model describing how work systems evolve through a combination of planned and unplanned change. The entity being analysed and improved is a work system, not an IT system. Furthermore, its life cycle view focuses on iterations of planned and unplanned change rather than on beginning to end steps in an IT project. (See Alter (2003, 2008a, 2008b) for details and clarifications.)

A "work system snapshot" is a central tool for using a work system approach to think about systems in organizations. As illustrated later in Table 2, this is a tabular one page summary of a work system that individuals or groups can use for clarifying the essence and scope of the IT-reliant work system that is being analysed. Subsequent analysis looks at each element more deeply.

This research effort extends Alter's relatively informal research It applies a new work system analysis template that had not been evaluated formally. It avoids possible bias related to evaluating data sets from Alter's own classes at his own university, where earlier versions of the work system method were developed. The earlier research was based on testing of successive iterations of work system analysis tools by employed MBA students attempting to perform preliminary analysis of IT-reliant work systems within their own organizations. Attempts to improve the next iteration were based on the quality of student papers plus their written feedback in a diary.

In the present research, the design artefact (the work system analysis template) was used by 75 employed business professionals - MBA students in three MBA programs at Georgia State University during the Spring 2009. This environment and the population of participants are important because the vast majority of the participants were early to mid-career business professionals expecting to advance their careers by applying the knowledge and tools in the MBA program . They are typical of business professionals who participate in system-related projects and who have a professional stake in the outcomes. The ability of this population to use a method for analysing systems in their own

organizations would imply that that method or a similar method could help empower other business professionals to analyse systems in that way.

3 THE RESEARCH DESIGN, SETTING AND NATURAL EXPERIMENT

Research Design. One of the authors had previously incorporated a highly simplified version of the Work System Method as described in Alter (2002) as an optional exercise in previous offerings of a required MBA course. Review of roughly 20 applications during one year revealed that employed MBA students were energized their ability to apply the technique in their work settings. As a result, the instructor decided to make this technique a required component of the next iteration of the course. That instructor contacted Alter to discuss how to apply it best in the curriculum and workplace.

The design artefact was used in an IS survey course emphasizing the significance of business processes, how processes are modelled, and how automation of processes can further tactical and strategic goals. The work system analysis assignment was an important component that preceded the course's coverage of IS development and project management.

The use of the artefact was designed as a natural experiment, with employed MBA students applying a work system analysis template to familiar work situations and real work problems. This was not an artificial textbook problem, nor was it based on a pre-developed, pre-tested scenario as in a controlled experimental situation (Lee and Truex 2000). The exercise contributed 15% of the total grade, roughly the same as the final exam. In the workplace the exercise provided an opportunity to apply the technique to current problems. The instructor recounted past uses of the tool with reported results ranged from improved job performance ratings to actual promotions and job assignment changes.

Each student subject was in one of three different MBA programs in which the class was a required core course. Students in each of the three programs averaged 6 to 7 years of business experience and 28 years of age. One program is a full-time, lock-step cohort program offered jointly by three universities, one each in the United States, Latin America, and Europe. Parts of courses are taken in China, Europe, Latin America and the United States. The second program was a traditional part-time, non-cohort MBA program whose students took classes in varying sequences. The third program was a part-time professional, lock-step, cohort MBA program that met on alternate Saturdays. Students in these programs were employed by domestic, multi-national, and foreign-based firms in manufacturing, energy, services, food, transportation, and the public sector. The individual companies ranged from small entrepreneurial businesses to major Fortune 500 companies.

Instructions and examples provided as a starting point. The work system analysis template that the students used was an outline for a preliminary analysis of a work system. It was distributed and explained during several class meetings after the students read two summaries of work system ideas (Alter, 2002; 2008b). The assignment description guided student work. In two of the course sections students brought preliminary versions of work system snapshots to class and received team feedback. Several exemplars were shared during class discussion along with instructor responses to questions.

The deliverable was a written management report (executive summary, background, etc.) based on the work system analysis template. An appendix contained a required set of tables plus other descriptive entries. Some participants provided benchmarking data and lengthy 'as is' descriptions of the current system; others were more parsimonious in detail. In our judgment the deliverables were equivalent to a midrange briefing that might be presented to a manager or a committee that would decide whether to put more effort into the analysis and how to allocate resources among various proposed projects. Given time limitations, participants were not expected to provide the level of detail required to produce a usable cost/benefit analysis or to create software. Neither the artefact nor the assignment was designed to provide a detailed process model or object-oriented description of a system.

Analysis of the results. The analysis examined deliverables describing specific work systems. The 75 papers were read and evaluated by the instructor and one of two assistants who were evening students in MBA programs at the university. The instructor was a university professor with substantial expertise in ISD methods and IS architectures. One assistant was an IT manager in the federal courts with significant experience in modeling business processes and in ISD. The other assistant was a Ph.D. chemist who was working as a technical manager and who had substantial management experience. Much as would happen in a real world situation, each deliverable was evaluated based on the face validity, rigor, and integrity of the analysis. Thus, the evaluations occurred in the context of the course and were based primarily on the academic and practice-based experience of the reviewers.

The evaluation process contained two steps. First, one of the assistants read, annotated, and classified each deliverable. Next, the professor independently read, marked, and graded each paper, keeping a diary of the common problems and surprising developments in using the artefact. A sampling of deliverables were shared in class sessions and served as the starting point for class discussions. The evaluation effort had two goals. The main goal was to provide detailed feedback and grades to the students. The second goal was to evaluate the design artefact and identify ways to improve it.

4   THE DESIGN ARTEFACT AND THE SYSTEMS ANALYSED

This research tested a work system analysis template (the design artefact) adapted from previous work system analysis research. Alter had used earlier versions in his MBA and EMBA classes but had not tested the artefact in a formal way. The new template included a new analysis tool called a "service responsibility table" (Alter, 2008b), which is illustrated through examples in Tables 3 and 4.

The design artefact was distributed as a Microsoft Word document to be used as a starting point for the analysis project and report. It contained headings for five prose sections and blank templates for the work system snapshot and other tabular information. The instructions to participants included:
- Write a brief paper with six required sections, the last of which is a required appendix.
- The first five sections are a prose explanation of a business analysis: Executive Summary, Background, System and Problem, Analysis and Possibilities, Recommendation and Justification.
- The Appendix guides a work system-oriented analysis. It includes a blank work system snapshot, blank tables for identifying problems and issues, summarizing the recommendation, summarizing arguments for the likely success of the recommendation, and a brief question about each of the elements of the work system.
- The participants were to complete the Appendix before writing the first five sections of the paper. In effect, the first five sections were to be a prose explanation of the mostly tabular and question-answer material in the Appendix. This organization of the deliverable guided the analysis work and provided practice in separating the details of analysis from a prose report for management.

In effect, the participants were asked to produce the type of analysis that might help managers and funding committees understand system-related issues and proposed improvements, thereby supporting communication about IT-reliant systems and facilitating decisions about whether or not to allocate resources to specific project proposals. Subsequent analysis beyond the scope of this assignment would delve into details more deeply and might generate formal cost/benefit calculations or detailed requirements specifications that are appropriate for approved projects.

Wide range of work systems. The analyses covered many types of problems and opportunities across many business functions. Table 1 lists typical examples of work systems that were analysed. Problems and issues in these work systems included inefficiency, long cycle times, excess delays, excess rework, poorly specified processes, and unclear expectations about evaluation criteria.

Illustrative example. Tables 2, 3, and 4 come from the Appendix of an 11-page submission from the manager of a testing laboratory who was in the first of the three course sections. The instructor distributed that entire write-up to the second and third sections to show the expected level of attention and detail. Tables 2, 3, and 4 illustrate the core of the analysis that students were to perform.

The participants read two articles about the work system approach, a very brief overview (Alter, 2002) published in *CIO Insight* seven years earlier and an *IBM Systems Journal* article (Alter 2008b) about service system fundamentals. Both explained a basic tool called a work system snapshot (Table 2). The second article introduced a service value chain framework and a related tool called a service responsibility table (see Tables 3 and 4). The idea underlying both the service value chain framework and the related tool is that value from services tends to be co-produced by providers and customers. Comparison with Alter (2008b, Tables 1 and 2) reveals that the form of the current Table 3 is more useful than the originally intended form of this table. The customer column was supposed to refer to the customer of the entire process. In Table 3 the customer column refers to the customer of the step in adjoining cell in the first column. That approach provides a better way of thinking about difficulties at each step in the process. The submission that included Tables 2, 3, and 4 was not only understandable, but actually turned out to be helpful in practice, according to its author.

5   ANALYSIS OF THE RESULTS

The 75 models and reports were evaluated by the instructor and one of two highly qualified research assistants based on face validity, rigor, and integrity of the analysis. The evaluations recognized that the work system analysis template was designed for use by business and IT professionals engaged in initial discussions of business problems and related work system improvement projects.

Effectiveness. The most important conclusion is that employed MBA students succeeded in using the design artefact effectively for producing high-level models of IT-reliant work systems. The evaluation of the papers found that most students produced understandable and at least reasonably well argued reports even though they received relatively little documentation of work system concepts and prior work system examples, and even though this assignment was only part of the workload from an evening MBA course for individuals who were already working 40 or more hours per week. This suggests that use of this analysis tool could help business professionals think about IT-reliant systems analytically and communicate with IT professionals in system-related projects.

Written feedback from one subject stated:

 "Previous to [this course], all of my exposure at [this university] to process improvement has been in the context of Lean Six Sigma. I found the concepts in Work Systems Modeling easier to understand and they seem to be more widely suited to general business professionals interested in process improvement. I have since used the technique learned to begin efforts to improve the Product Development process at [my place of business] and have begun to share the methodology with colleagues." (participant M053)

Appropriateness of this type of analysis. Almost all of the submissions recognized the desirability of starting the analysis without assuming that automation or computerized support of processes should be the goal. To the contrary, almost all of the papers recognized the goal of understanding the business situation, describing business issues, and thinking about possibilities for change.

Communicative value. For most students the assignment required conversations with business colleagues who were familiar with specific aspects of the work system they were analysing. In classroom discussions many of the students reported using the work system snapshot and other topics in the design artefact as a central focus. The students unanimously agreed (i.e., there were no dissenting views) that the appendix of the design artefact was valuable for promoting organized communication and inquiry about the work system they were analysing.

Timekeeping for field technicians for a public utility	Performing portfolio management in a wealth management group	Finding and serving sales consulting clients
Receiving materials at a large warehouse	Scheduling and tracking health service appointment	Determining government incentive for providing employee training
Controlling marketing expenses	Determining salary increases	Performing financial planning for wealthy individuals
Acknowledging gifts to a high profile charitable organization	Operating an engineering call center	Planning for outages in key real time information systems
Performing pre-employment background checks	Administering budgets for grants	Approving real estate loan applications
Purchasing advertising services through an advertising agency	Collection and reporting of sales data for a wholesaler	Acquiring clients at a professional service firm
Planning and dispatching trucking services	Determining performance-based pay	Invoicing for construction work
	Insurance policy renewals	

Table 1. Examples of work systems analysed

Customers	Products and Services
Plant Managers Quality Control Managers Product Integration Managers Package Designers Sales Engineers Package End Users	Expert Opinions Laboratory Reports Laboratory Data

Work Practices (Major Activities or Processes)
Laboratory service requests for plastic bottle testing are submitted by the requestor via our corporate intranet utilizing Sharepoint functionality. Laboratory service requests are routed to the laboratory manager and initially scrutinized A follow up is then initiated with the requestor if needed to ascertain a better understanding of the requestor's objectives as they relate to the service request. A laboratory technician is assigned to the request by the laboratory manager. A test plan that meets the objectives of the request is then developed by the laboratory manager and the technician. The technician executes the test plan on the bottles and collects the necessary data outlined in the test plan. The technician completes the test plan by summarizing the data collected and submitting it to the laboratory manager for review. The data is scrutinized by the laboratory manager in terms of meeting the objectives of the requestor and either orders follow-up testing by the technician or if the data is deemed sufficient a laboratory report is completed that explains how the data meets the requestor's objectives. The completed laboratory report is communicated electronically to the requestor and the laboratory manager follows up with the requestor to make sure the requestor's objectives have been met satisfactorily. The laboratory service request is then closed out.

Participants	Information	Technologies
Requestor Laboratory Manager Laboratory Technician Materials Scientist Internal Subject Matter Expert External Subject Matter Expert	Laboratory Service Request Problem Description Requestor Interview Package Specifications Industry Test Methods Laboratory Test Data Laboratory Reports	Corporate Intranet Sharepoint Microsoft Excel Template Microsoft Word Template Laboratory Test Equipment Telephone and E-Mail

Table 2: Work System Snapshot for Request Fulfillment System in a Testing Laboratory (from an MBA student's submission using the design artefact)

Problems, issues, and opportunities for the system as a whole
The laboratory objective is to complete service requests within 3 business days of request receipt but the current average time is greater than 5 days (est.)
Incomplete submission of the service request by the requestor occurs 66% (est.) of the time which must be followed up with and completed before work can begin.
Technicians are often assigned 5 or more requests simultaneously and this often results in reports of technicians being overwhelmed.
Test plans and procedures are executed incorrectly at least 2 times per month (est.) and this leads to rework and delays.
In at least 50% of cases (est.) the test data collected is often much more than is needed to meet the objectives of the requestor and thus represents non-value added activity.
At least once every 2 weeks (est.) either serious or minor errors appear in the reporting of results to the laboratory manager which results in lost time due to double checking of all results.
Laboratory technicians report once per month (est.) that they did not understand the purpose of the test plan and this sometimes leads to the omission of significant observations that can be relevant to the requestors objectives
Service requestors request 3 times per month (est.) that completed laboratory reports be communicated in more of a laymen's fashion.

Problems, issues, and opportunities by step		
Provider Activity or Responsibility	*Customer Activity or Responsibility*	*Problems, Issues, Opportunities*
Laboratory personnel completes service request in 3 business days	Requestor utilizes results of service request to meet business objectives	Requests exceed 3 days
Laboratory manager understands objectives of requestor through laboratory test request	Requestor presents a clear description of what needs to be achieved by fulfillment of the service request	Incomplete request forms
Laboratory manager must distribute the work load evenly among technicians	Technicians must complete all assigned test plans	Large work loads
Laboratory manager provides guidance and help creating a test plan	Technician inputs on test plan formulation and then executes against the plan	Tests executed improperly
Laboratory manager provides guidance and help creating a test plan	Technician inputs on test plan formulation and then executes against the plan	Too much data collected
Laboratory technician collects and summarizes test plan data	Laboratory manager uses the assembled data to formulate a report	Data reporting errors
Laboratory manager communicates the objectives of the requestor to the technician	Technician understands the purpose of the testing and evaluates fitness of results against objectives	Lack of test understanding
Laboratory manager communicates results clearly	Requestor utilizes results of service request to meet business objectives	Results in laymen's terms

Table 3. Problems, Issues, and Opportunities for work system summarized in Table 1 (from an MBA student's submission using the design artefact)

Recommendations for the system as a whole
• In order to meet the objective of completing work requests in 3 business days we will initiate improvement activities in 5 of the major activity areas captured in the work system snapshot presented in Appendix I.
• Understand how and why the service request form is only partially completed and then improve thus communication of requestor objectives will happen the first time and time will not be wasted.
• To reduce feelings of being overwhelmed we will reduce the number of projects assigned concurrently to technicians from 5 to 2. They will concentrate more on what is at hand and not rush to lower the pile. Reductions in reporting errors will also be addressed by this recommendation since more quality time will be utilized in the testing.
• Laboratory technicians will take a more active role in formulating test plans which will drive a more fundamental understanding of the requestor's objective and what is needed for it to be met. The result will

be technicians that better understand the objectives and a more meaningful examination.		
• An analysis of service requests will be completed and clusters will be identified. Tests plans for each cluster type will be developed and then followed where applicable thus reducing extra testing and unneeded time formulating a plan for routine service requests		
• A review of laboratory reports that were requested to be put in more laymen's terms will be analyzed. A comparison of before and after versions of laboratory reports and recognition of their requestors identity will drive improved communications by achieving a better understanding of the audience.		

Recommendations by step		
Provider Activity or Responsibility	*Customer Activity or Responsibility*	*Recommendation*
Give complete information in regards to service needed and objectives	Understand drivers of incomplete requests and take corrective action	Improve degree of completeness on service request form
Laboratory manager will not assign more that 2 service requests to a technician	Technician will complete service request in an accurate and timely matter	Reduce assigned work load to technicians
Laboratory manager will delegate more of the test plan genesis	Technician will take a more active role in developing test plans	Increase technician role in formulating test plans
Laboratory manager will generate generic test plans based on clusters	Technician will use generic test plans and only add tests as needed	Cluster analysis of laboratory requests
Laboratory manger simplifies language in laboratory reports	Provide feedback on understanding of laboratory reports	Improve readability of laboratory reports

Table 4: Recommendations for work system summarized in Table 1 (from an MBA student's submission using the design artefact)

More appropriate than tools and methods for IT professionals. The range of systems in these 75 examples demonstrates that business professionals encounter systems that rely on IT to varying extents. Accordingly, analysis tools and methods for business professionals should help them come to grips with system-related issues that may or may not involve IT directly. The work system analysis template proved both usable and useful because it helped the MBA students obtain initial understandings of their own organization's systems using business concepts that were generally familiar and did not involve complex technical terminology or tools.

Capturing the essence even with some unclear or confused details. Many of the responses seemed to capture important aspects of the situation and seemed to make meaningful recommendations even though some details about the use of work system terminology were unclear or confused. This implies that the design artefact could be used somewhat successfully even without getting all of the details right because it provides a structure for capturing enough details that the essence of the situation tends to emerge. Subsequent discussions in real projects would identify and correct mistakes in the original thinking and would develop detailed requirements that would be more rigorous and precise.

5.1 Difficulties in using the artefact

A number of problems were encountered in using the design artefact. Many of these problems can be addressed by a combination of clearer definition of terms, examples of effective use of work system concepts and tools, and examples for alerting users about common confusions.

Difficulties naming the work system. Neal Postman (1988) said: "So in naming meaning begins." The instructions asked the students to name the work system using a phrase such as "process for reimbursing travel expenses" or "process for printing books." Examination of the submissions revealed that nearly half of the papers did not name the work system or named it in an overly general manner that was not as informative as it could have been. (e.g., "financial accounting system" instead of "process for generating month ends financial statements"). A simple way to avoid this problem in the future is to provide a list of typical work system names such as those in Table 1.

Confusion about the definition of terms. The work system approach uses terms such as a customer, products and services, and processes and activities in particular ways. Confusions included:

- Treating anyone who receives anything as a customer. (The term customer refers to someone who receives and uses at least one of the products and services that the work system generates for use other than intermediate use to do work within the work system.)
- Ignoring the difference between customers and other stakeholders. (Some papers listed managers as customers even though they did not receive or use the work system's outputs).
- Confusing the product of a work system with the product of the firm. (The product of a work system is what it produces, which is often not what the company produces for its customers.)

Lack of clarity about the desired use of service responsibility tables. More than half of the tables of problems and opportunities and tables of recommendations (See Tables 2 and 3) were inconsistent with the format suggested in Alter (2008b, Table 2), which assumed that the tables would have one row for each step listed in the work system snapshot. One reason for the disparity is that the instructor did not emphasize that relationship. Several alternative formats emerged. A future version of the artefact may include a choice among several formats for several of the tables.

Non-attention to column headings. In a number of papers, entries in the cells in the first two columns of the service responsibility tables (see Tables 2 and 3) seemed to ignore column headings and simply used the tabular format to identify problems, issues, and recommendations, many of which made sense when read without considering the column headings. In the future, the meaning of column headings in documentation and instructions should be emphasized.

5.2 Implications for improving the artefact

As proposed in Hevner et al (2004), improvement of the design artefact is a desired and expected step in design science research. A new version of a previously existing tool was tested in a new setting where the users were the type who would use it in real world settings and who had appropriate contextual knowledge (i.e., were not undergraduates performing a highly artificial task outside of a real world context). Use of the design artefact led to the following suggestions for improvement:

Emphasizing definitions of terms. Terms such as customer, products and services, and participants are defined in a particular way in the work system approach. Production of clear, useful work system snapshots requires careful use of those terms. Future versions of the design artefact should provide more effective guidance, either passive or active, toward using work system terminology consistently.

Providing more guidance about scope. Many of the students had difficulty deciding how much detail to provide. That is not surprising, given that work systems can be described at many levels of detail. In the future it will be possible to provide several annotated examples that illustrate different levels of detail and call attention to aspects of a work system analysis that are not obvious, such as the consistency conditions between different parts of the work system snapshot (e.g., that each role listed under participants should be mentioned in at least one step listed under processes and activities). These examples would be viewed as separate from the artefact, just as documentation is viewed as something separate from a computer program.

Providing a computerized tool. Evaluation of the submissions revealed areas where the inherent structure of the work system analysis template could be linked to deeper work system knowledge through a computerized tool. Such a tool would help the analyst by guiding the analysis through the use of computerized templates, drop down menus, readily available help, and readily available examples. The existing submissions could be useful in developing a preliminary draft of that tool. Simply looking at the Appendix of each submission in turn and asking how a tool might have helped could lead to a preliminary specification that could be explored further through simulations and discussions with potential users.

Linking work system analysis to methods and tools for IT professionals. The above conclusions about improving the design artefact are basically about helping business professionals produce clearer descriptions of business situations without requiring that they use tools and methods that even many IT professionals find opaque, inappropriate, and overwhelming. Beyond the scope of this paper,

ongoing research is attempting to forge conceptual and heuristic links between the types of information included in the submissions and the more precise and rigorous documentation that IT professionals need in order to produce detailed requirements specifications against which programs can be designed and tested.

5.3   Further analysis of the submissions

The main design science research goal was to test whether business professionals could use the work system analysis template effectively. Further analysis of a subsequently expanded sample of 153 models/reports will use latent semantic analysis. A future effort to code the papers could identify submissions that share specific characteristics and therefore might be analysed as a subgroup. Possible items for coding include industry group, business function, number of customers listed on the work system snapshot, the number of and type of metrics that were mentioned, and use or non-use mobile technologies. Coding of the papers could support interpretive analysis addressing issues such as:

Incremental changes vs. big picture innovations. Despite the emphasis on process innovation throughout the course, almost all of the papers focused primarily on incremental changes in existing processes. Most papers identified 10 to 20 steps in the work system snapshot, and focused on improving specific steps. Starting with fewer, more highly aggregated steps would have been more conducive to process innovation because the details of a more highly specified process create an anchoring effect that inhibits consideration of radical changes. Also, relatively few papers explicitly discussed big picture characteristics such as degree of structure in decision making, complexity, degree of integration, degree of automation, and rhythm of processes. These topics were not discussed explicitly in the course and might have appeared more extensively had they been covered.

Types of argumentation. The papers used different types of argumentation. Some cited metrics explicitly and argued in terms of specific performance improvements (e.g., 50% faster, or 20% less rework). Others paid little attention to metrics and focused on current vs. proposed process logic. Only a few mentioned anecdotes as part of the analysis. Despite substantial attention to analysis of data throughout the MBA programs, less than 10% of the papers presented tables or graphs of statistical data. The sparse use of numerical data and metrics implied that carefully collected operational data that could have been helpful either does not exist or is difficult to obtain in many of the work settings.

Use of metrics. Some papers used metrics extensively. Many others mentioned just a few metrics. Some of the papers argued primarily in terms of process logic and said almost nothing about metrics. Given that most students had taken two accounting courses prior to this course, it is surprising that metrics were not cited more extensively.

Reliance on automation. A number of papers recommended automation of manual steps or processes. In some cases, the result would be a largely automated process. In others, it would be a largely manual process with a few automated steps. It would be interesting to analyse the extent to which automation was suggested and the situational factors that seem related to those suggestions.

Impact of people. Very few of the papers mentioned the impact of characteristics of work system participants, such as skills, incentives, attitudes, and certifications. This scant attention to human resources may have resulted from the nature of the course, or it may have resulted from a belief that characteristics of participants have a much smaller impact than the formal process. It would be interesting to tease out comments about system participants and customers, and to trace the extent to which their characteristics matter in the analysis.

5.4   A step toward empowering business professionals

The results from the current research are an incremental step along a path that appears to yield substantial benefits to business and IT professionals alike. IS/IT research to date has generated important knowledge about many topics, but has not solved persistent problems related to systems analysis and design, business/IT communication, user participation, risk analysis, and many other

important topics. The current research demonstrates progress in an under-researched area. This research won't "solve" these problems but could help substantially. Instead of looking for factors that are statistically related to user participation or developing high precision tools for IT professionals, this research provides methods and tools that empower business professionals to think about systems more effectively in their own terms and for their own purposes. The results reported here show that business professionals can use this type of technique. Much work remains in making the approach available to business professionals and in continuing research to make it more effective.

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