Service Responsibility Tables: A New Tool for Analyzing and Designing Systems

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Complete List of Authors:	Alter, Steven; Univ of San Francisco, SOBAM

SERVICE RESPONSIBILITY TABLES: A NEW TOOL FOR ANALYZING AND DESIGNING SYSTEMS

Steven Alter
University of San Francisco
alter@usfca.edu

Abstract

Initiatives related to the proposed development of "services science" created a challenge for further development of the work system method, a systems analysis method designed for business professionals: Would it be possible to develop a version of the method that specifically addressed services? Although that research is on-going, thinking about services as a special type of work system led to the development of a simple but flexible tool that could be useful in describing, analyzing, and designing most systems in organizations.

Service responsibility tables (SRTs) are simplified, two-column swimlane diagrams that identify specific step-wise responsibilities of service providers and service customers. SRTs can be used regardless of whether the customers are internal or external. The form of SRTs reflects the two-sided "co-production" of services by providers and customers that is cited in the marketing and service literature. SRTs may contain optional columns for selected analysis or design topics such as problems and issues, performance gaps, and information created or used by each activity. SRTs can be used to clarify the scope of the system and the problems and issues at hand. SRTs with various optional columns can also be used throughout the analysis and to clarify and sanity check recommendations.

Keywords: Systems analysis and design, service, work system, service system, service responsibility table, work system method

A Challenge Related to Services

Services comprise nearly 75% of the U.S. economy (Horn 2005). Recognizing the large percentage of its revenues that services produce, IBM has promoted a major initiative to encourage the development of "services science" along with the development of instructional programs in SSME (services science, management, and engineering). The July 2006 edition of the *Communications of the ACM* contained a special section on services science that included 13 papers such as Chesbrough and Spohrer (2006), Bitner and Brown (2006), and Maglio et al (2006). Editorial notes in *Information Systems Research* (Rai and Sambamurthy 2006) covered similar territory with special emphasis on opportunities for IS scholars.

Growing interest in services science generated a challenge for the further development of the work system method (Alter 2006), a systems analysis method developed to help business professionals analyze systems for themselves, with or without

the help of consultants and IT professionals. Perhaps it would be possible to develop a special version of the work system method that would focus on analyzing services. Perhaps that version would be based on a different version of the work system framework (Figure 1) or would provide a new framework specifically related to services.

This paper focuses on a new tool that was developed as part of the effort to extend the work system method. Typical systems analysis approaches used in developing most information systems treat the system's customer as a "user." An alternative view brings the customer into the system, not just as a user or recipient of whatever is produced, but as a co-producer of services, a role that is cited in definitions of service in the marketing and service literatures. The challenge for systems analysis is to determine how co-production of services can be taken seriously in systems analysis methods and tools.

This paper proceeds as follows. The next two sections summarize the work system framework, which has been described many times, and the service value chain framework, which was first described in Alter (2007). The two-sided structure of the latter framework led to the format of service responsibility tables (SRTs), simplified two-column swimlane diagrams that identify step-wise responsibilities of service providers and service customers. It is easy to augment two-column SRTs with additional columns related to problems and issues, performance gaps, and many other topics. SRTs can be used in a number of ways as a standalone tool and are being incorporated into an improved version of the work system method. Pilot use by undergraduate and MBA students indicates that SRTs are a practical tool that can be used with relative ease, unlike many other tools that are used in systems analysis and design.

Work System Framework

The work system framework (Figure 1) was originally developed to help business professionals recognize and understand IT-reliant systems in organizations. (Alter 2003, 2006) 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 services for internal or external customers. Figure 1 identifies nine elements that are part of even a rudimentary understanding of a work system. Four of the elements in Figure 1 (processes and activities, participants, information, and technologies) constitute the work system. The other five elements fill out a basic understanding of the situation. The customer appears at the top because a work system's primary goal is to produce products and services for customers. The work system framework does not preclude the possibility that customers will perform self-service steps, however, because a customer can also be a participant. (The version of the work system framework in Figure 1 is a slight revision of the work system framework depicted in Alter (2006). The revision replaces the term "work practices" with the term "processes & activities" which is more suggestive of the steps in performing a service, regardless of whether the service is produced through a highly structured workflow or through an "artful process" (Hill, et al 2006) whose sequence and resolution depend on judgment and knowledge rather than well-defined rules.)

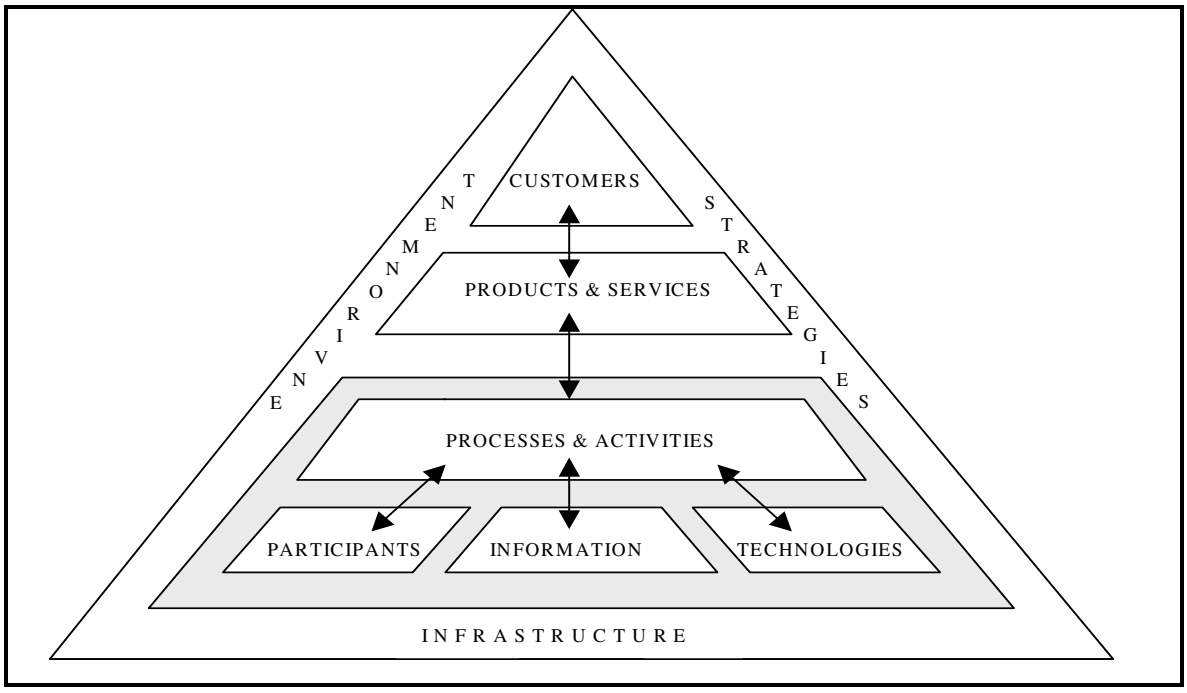

Figure 1. The Work System Framework (slightly updated). Source: Alter (2006), all rights reserved.

Although the work system framework has been used successfully to summarize work systems involving services (e.g., Petrie 2004, Petkov and Petkova 2006), it seemed possible that a service-focused framework might lead to additional insights.

The Service Value Chain Framework

Service systems are work systems that are largely devoted to producing services. The unresolved debate about the definition of services (e.g., Sampson and Froehle, 2006) is beyond the scope of this paper. For our purposes, a dictionary definition of service suffices, "work done by one person or group that benefits another." (WordNet 3.0) By that definition of service, most work systems are service systems.

The service value chain framework (Figure 2) outlines generic activities and responsibilities of both service providers and customers. These activities and responsibilities may occur before, while, and after a specific service is delivered to a specific customer. The framework is based on the following assumptions:

- A full understanding of a service system requires attention to activities and responsibilities of both service providers and service customers because "the value from services is often "co-produced" jointly by the service provider and service buyer." (Dietrich and Harrison 2006). Co-production is part of some definitions of service, such as "a time-perishable, intangible experience performed for a customer acting in the role of a co-producer." (Fitzsimmons and Fitzsimmons 2003) "Customers' participation in service co-production processes has been increasing with the rapid development of self-service technologies and business models that rely on self-service as the main service delivery channel." (Xue and Harker 2003)

- Customers of a service system are individuals, groups, or organizations that receive benefits created by the activities it performs. Many services have different customers of different types. Each of a service system's various customers or customer groups may fall into one or more of the following categories, all of which are relevant for understanding the dynamics of various types of services:
  - … Internal and external customers
  - … Direct customers and indirect beneficiaries
  - … Intermediate customers and end customers
  - … Paying customers and non-paying customers
  - … Contracting customers and non-contracting customers
  - … Voluntary customers and involuntary customers
  - … Non-computerized customers and computerized customers (a conceptual link to service computing)
  - … Other stakeholders

- Basic ideas about services are largely the same regardless of whether services are directed at external customers, internal customers, or both.

- Customer satisfaction is affected by the complete set of experiences that typical customers associate with acquiring, receiving, and benefiting from a particular service. For example, the customer experience in receiving a flu vaccination might include going to a clinic, signing in, paying for the vaccination, waiting while others receive their vaccinations, receiving the vaccination, and, in many cases, feeling thankful months later that a flu case was averted.

- Many service situations involve delivery of services based on negotiated commitments under which the service may be delivered many times. The outsourcing literature often notes that the quality and thoroughness of negotiated mutual commitments is a key determinant of whether long term service agreements will meet needs and will be cost effective. (e.g., Cullen et al 2005)

- Although the fulfillment of a service request is typically viewed as the core of the service, activities related to awareness, negotiation, setup, handling of the request, and follow-up are also important determinants of service performance.

- Preparation by providers and/or customers prior to each instance of service delivery is often essential for service efficiency and effectiveness. For example, failure to fast overnight before taking a blood test that requires fasting will generate erroneous results regardless of how well the test is performed.

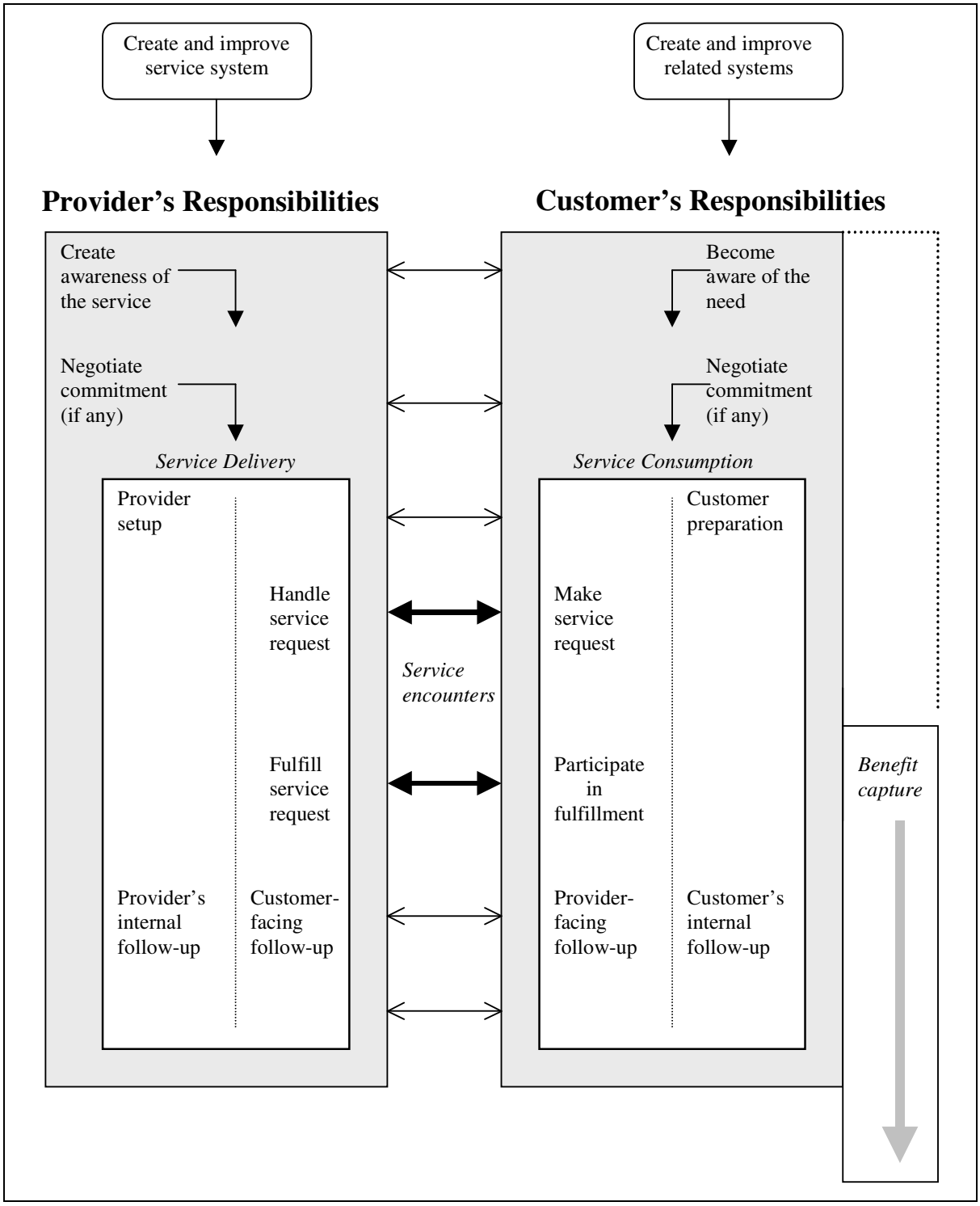

Figure 2: Service Value Chain Framework. Source: Alter (2007), all rights reserved.

- For many services, each instance of service delivery includes a customer's explicit or implicit service request. The handling of the service request is an important part of service delivery and often affects customer satisfaction.

- Services often involve front-stage and back-stage activities by both service providers and customers (e.g., Teboul 2006). The quality of service encounters (e.g., Czepiel et al 1985) between service providers and customers is often a key determinant of customer satisfaction.

- Some services require follow-up by providers and/or customers. Follow-up may be related to a single service instance (Was the installation OK?) or may refer to multiple service instances (How responsive is your account manager?).

- Benefit capture is a customer's process of receiving the primary benefits that were sought. Customers may experience benefits as the service is produced and/or may experience benefits later. For example, the benefit capture from receiving a flu vaccination occurs over the subsequent flu season when the vaccination prevents or minimizes a case of the flu. In contrast, benefit capture when attending a baseball game occurs primarily during the experience of the game, and partly during anticipation of the game and recollections afterwards.

A New Tool for Systems Analysis and Design

Most work systems are actually service systems. Therefore, concepts in the service value chain framework might facilitate the analysis of a large percentage of systems by highlighting ideas and distinctions that a provider-centric analysis might overlook, such as:

- customer responsibilities and issues, not just the service delivery process
- benefit capture over time
- service encounters before, during, and after service delivery
- front-stage and back stage activities
- the form and content of negotiations and service requests
- preparation prior to service fulfillment
- follow-up subsequent to request fulfillment

Bringing ideas such as these to the foreground in systems analysis and design shifts the frame of reference in a way that might generate significant new insights during the analysis of some systems. The basic terminology of the IS field implies that systems are tools that are "used" by "users" through "user interfaces." Systems analysis tools such as flow charts, DFDs, and ERDs tend to focus attention on provider activities and on technical artifacts that are being built, rather than on co-production. UML is designed to encourage emphasis on "use cases," and therefore clearly emphasizes the use of technical artifacts that are being built or improved. By implication, a systems analyst's job is to elicit and perfect the requirements that technical artifacts should satisfy. In contrast, an analysis approach emphasizing the co-production of services treats the customer part of the system, and focuses attention on the complementarity between customer and provider responsibilities.

Even without forcing any of the concepts listed above into the analysis, it is easy to translate the two-sided format of the service value chain into a useful and flexible analysis tool called a service responsibility table (SRT). As shown in the example in Table 1, the simplest form of SRT is a two-column swimlane diagram, with one column for providers and one column for customers, and with specific provider and customer roles indicated clearly. All of the entries in Table 1 are activities, although it is possible for entries in a two-column SRT to be responsibilities, such as a patient's responsibilities while undergoing a physical exam or a traveler's responsibilities during an airplane flight.

Table 1: Two-Column Service Responsibility Table (SRT) for a Loan Approval System

Provider Activity or Responsibility	*Customer Activity or Responsibility*
Loan officer identifies businesses that might need a commercial loan.	
Loan officer contacts potential loan applicant.	**Potential loan applican**t agrees to discuss the possibility of receiving a loan
Loan officer discusses loan applicant's financing needs and possible terms of the proposed loan.	**Potential loan applicant** discusses financing needs.
Loan officer helps loan applicant compile a loan application	**Loan applicant** compiles loan application.
Loan officer and **senior credit officer** meet to verify that the loan application has no glaring flaws.	
Credit analyst prepares a "loan write-up" summarizing the client's financial history, providing projections of sources of funds for loan payments, etc.	
Loan officer presents the loan write-up to a senior credit officer or loan committee.	
Senior credit officer or **loan committee** makes approval decision.	
Loan officer informs loan applicant of the decision	**Loan applicant** accepts or declines an approved loan.
Loan administration clerk produces loan documents for an approved loan that the client accepts	

Use of a two-column SRT early in the analysis of a system potentially serves several purposes:

- It identifies step-by-step roles and responsibilities in the same table, thereby clarifying the scope and context of the service without requiring mastery of details that will be documented later through detailed representations of workflow and logic.
- It focuses attention on activities and responsibilities rather than on details of technology and information.
- It identifies the job roles that are involved.
- It brings customer responsibilities into the analysis.
- It identifies steps involving service interactions (rows with both provider and customer responsibilities) and other steps that are not visible to customers.

The format of an SRT facilitates easy reuse as the analysis proceeds. For example, it is easy to extend a two-column SRT into a three-column SRT by adding a new column for any of a number of topics that might be important for analyzing a particular system. Table 2 shows a three-column SRT whose third column summarizes the problems and issues that launched the analysis and associates each problem or issue with either a specific step or the work system as a whole. This type of summary would have helped in clarifying the problems and issues in many past uses of the work system approach by MBA and EMBA students. Table 3 identifies typical examples of topics for the third column (and possibly the fourth or fifth).

Note that an additional row for the entire service system was added near the top of Table 2. That type of row (either at the top or bottom) is useful for summarizing metrics for the entire system (such as total cycle time or total capacity) or issues for the entire system (such as participant burnout or overall customer satisfaction).

Table 2: Three-Column Service Responsibility Table (SRT) for a Loan Approval System

Provider Activity or Responsibility	*Customer Activity or Responsibility*	*Problems or Issues*
System as a whole		• Inadequate profitability of the bank • Questions about whether incentives of the bank are aligned with incentives of system participants.
Loan officer identifies businesses that might need a commercial loan.		• Loan officers are not finding enough leads.
Loan officer contacts potential loan applicant.	**Potential loan applican**t agrees to discuss the possibility of receiving a loan	
Loan officer discusses loan applicant's financing needs and possible terms of the proposed loan.	**Potential loan applicant** discusses financing needs.	• Loan officer is not able to be specific about loan terms, which are determined during the approval step that occurs later.
Loan officer helps loan applicant compile a loan application	**Loan applicant** compiles loan application.	• Loan applicant and loan officer sometimes exaggerate the applicant's financial strength and prospects.
Loan officer and **senior credit officer** meet to verify that the loan application has no glaring flaws.		• 20% of loans applications have glaring flaws.
Credit analyst prepares a "loan write-up" summarizing the client's financial history, providing projections of sources of funds for loan payments, etc.		• 10% rate of significant errors, partly due to an error prone combination of several spreadsheets and a word processing program. • Much rework due to inexperience of credit analysts.
Loan officer presents the loan write-up to a senior credit officer or loan committee.		• Meetings not scheduled in a timely manner. • Questions about exaggerated statements by some loan officers.
Senior credit officer or **loan committee** makes approval decision.		• Excessive level of non-performing loans. • Rationale for approval or refusal not recorded for future analysis.
Loan officer informs loan applicant of the decision	**Loan applicant** accepts or declines an approved loan.	• 25% of refused applicants complain reason is unclear. • 30% of applicants complain the process takes too long.
Loan administration clerk produces loan documents for an approved loan that the client accepts		

In a diagram that would not fit the format or size limitations for these Proceedings, Alter (2007) presents an extended version of Table 2 that contains two additional columns, one showing the recommendation related to each step (i.e., leave it as is or modify it in a particular way) and an estimate of the likely performance impact of the recommendation for each step. Presented in landscape (horizontal) layout, that five-column SRT provides a terse and easily understood summary of the situation, the problem, and the recommendation. Once again, establishing a clear link between proposed changes and the problems and issues they purport to address would have generated clearer analyses and clearer conclusions in many past attempts by MBA and EMBA students to analyze work systems.

Table 3: Examples of Topics for the Third Column of an SRT

Topics related to problems or issues	Topics related to the system's structure and requirements	Topics related to performance metrics
• Issues and problems by step (See Table 2) • Participant or interpersonal issues by step • Information issues by step • Technology issues by step • Confusion or training issues by step • Possible points of friction by step • Possible reasons for rework by step • Communication issues by step • Training issues by step • External dependencies by step • Conflicts with other systems by step	• Goals and requirements by step • Information that is used in each step • Information that is generated in each step • Conditions that trigger each step • Products and services produced by each step (and used in other systems by customers or provider organizations) • Possibilities for change • Constraints related to each step (i.e., things that cannot change) • Benefits provided to customers by each step	• Number of hours devoted to each step • Average delay between steps • Average error rate at each step • Average provider cost of each step • Number of customer complaints related to each customer-facing step. • Key performance gaps for important steps (Gap = desired vs. current value of an important metric.)

Features and Uses

The most unique feature of SRTs is that the inclusion of parallel columns for provider and customer responsibilities encourages the analyst to take service co-production seriously. Use of this type of description makes it more likely that customer activities and responsibilities will not be overlooked in the analysis, and further, that otherwise hidden assumptions about customer roles, issues, and needs will be examined.

SRTs are not meant as detailed documentation of process or program logic. For example, the sequence of responsibilities should represent a typical sequence, but it is not necessary for the sequence to be precise and repeatable every time. Thus, SRTs apply to highly structured, pre-defined workflows, and also apply to "artful processes" (Hill et al, 2006) that cannot be charted in advance because they unfold in different ways depending on the use of knowledge and judgment to interpret whatever is revealed in previous steps. Examples of such processes include medical examinations, management processes, planning processes, and analysis processes. Although applicable to structured and semi-structured processes, SRTs cannot be applied to complete improvisations unless at least some activities and responsibilities are described in advance.

SRTs are designed to be useful, flexible, and extremely easy to use. Given their format as simple tables that can be produced using a word processor, SRTs can be created, manipulated, and extended easily. For example, an initial two-column SRT can be extended to three columns by simply creating a new table as a copy of the two columns, adding another column, and filling in the additional information that is relevant to the new cells. In some cases it is possible to add a fourth or fifth column without making the table too complicated to understand quickly. As mentioned earlier, use of landscape (horizontal) rather than portrait (vertical) page layout may make 5 or 6 column SRTs practical to use.

It is possible to expand a two-column SRT into a complete swimlane diagram with a separate column for each role, and possibly with flow chart symbols to document flow logic. Complete swimlane diagrams are useful for documenting how processes cross roles; such diagrams can be used as embellishments of SRTs that summarize co-production in a simpler manner. SIPOC diagrams (supplier, input, process, output, customer) are another related type of summary diagram that might be used to document details not fully conveyed by co-production tables.

The tabular structure of SRTs is also conducive to creation of various standard versions that can be defined and used through database or spreadsheet software. For example, at the beginning of its systems analysis efforts, a particular firm might establish the common practice of using SRTs with the following third columns: issues and problems (by step), customer

benefits (by step), key performance gaps (by step), and constraints (by step). People in that firm would become accustomed to discussing a two-column SRT to define the scope of the system to be analyzed, and then using the additional SRTs as the initial basis for exploring typical analysis topics.

Many additional variations are consistent with an SRT's basic structure. For example, if it is important to remember that certain groups of steps occur in parallel, it is possible to add a narrow column that numbers the activities and gives the same number to activities that occur in parallel. If it is important to record non-sequential precedence relationships in an SRT (rather than in other documentation), it is possible to add two numeric columns, one that numbers each activity and another that identifies one or more direct predecessors of each activity.

The suggested form of SRTs does not contain reminders to include the various types of activities identified in the service value chain model, such as awareness, negotiation, preparation, handing of requests, fulfillment of requests, and follow-up. It would be possible to list those step types as guidelines in a template and to ask the user to erase whatever service activity types are unimportant or irrelevant in a specific situation. It seems more convenient to familiarize the user with the service value chain model and then allow the user to apply it in whatever way best fits the situation.

There are many potential ways to use SRTs when analyzing an IT-reliant work system:

- Use a two-column SRT to summarize the service value chain as the larger context within which problems or opportunities exist for the system that will be analyzed.
- Add a third column to the SRT to associate specific problems or opportunities with specific activities
- Use the three-column SRT to identify a subset of the service value chain that will be analyzed. This should be the subset of the responsibilities and activities in the SRT within which the problems or opportunities occur.
- As the analysis unfolds, incorporate into additional SRTs selected concepts related to the various elements of the work system framework. In this type of use, the additional column may be sparse. For example, if the column tries to identify coordination problems, it is likely that the main problems in a multi-step process will occur within only several steps.
- Document the analysis using SRTs with selected additional columns, plus templates and diagrams based on the elements of the work system snapshot (e.g., balanced scorecard, design characteristics, work system principles, etc.)

One of the main advantages of incorporating SRTs into the analysis of an IT-reliant work system is that these tables provide an easy way to maintain a big picture view (the two columns of the SRT) while also establishing and maintaining the association of various specifics (issues, metrics, structural characteristics, etc.) for each activity.

Pilot Testing

Initial pilot testing in generalist undergraduate and MBA versions of a course called Systems in Organizations during Spring 2007 indicates that two-column SRTs are a practical tool for use by students. Generalist students (non-IT majors) were able to use SRTs as a starting point for summarizing their own understanding of an existing or proposed system related to each of the following questions, which were part of larger assignments for specific class meetings in the early weeks of the course:

1. [After reading a Wall Street Journal article (Koppel and Jones 2006) related to Amtrak's difficulties related to accepting and paying millions of dollars of sloppy legal bills from law firms.] …. Identify evidence that something is wrong with the way Amtrak handles legal bills. Use a service responsibility table to propose an appropriate process for handling legal bills at Amtrak.	
Provider activity or responsibility	***Customer activity or responsibility***

In the Amtrak example, SRTs helped many students realize that Amtrak needed to establish guidelines for legal bills as part of the original long term contracts (prior to legal work related to specific legal matters) and that the law firms needed to conform to those guidelines when generating and submitting their bills. Further, Amtrak needed to follow up to make sure that legal bills were submitted in accordance with the guidelines.

2. Without doing any research, produce a service responsibility table summarizing what you think might be the business process for accepting freshman students into USF. Include a third column to classify each business process step as customer value added, business non-value added, or non-value added. [Subsequent assignments would require research about specific systems. This assignment without research was basically a warm-up to establish confidence and to explore various ideas about business processes using an example that students are familiar with. Also, the value-added categories were explained in reading material from a Six Sigma text.]		
Provider activity or responsibility	***Customer activity or responsibility***	***Category (CVA, BNVA, or NVA)***

The freshman acceptance example stipulated that the students not do research, but only imagine the steps in the process based on their own personal experience with applying for admission. The goal was partly to exercise SRTs and partly to illustrate that different observers often have vastly different views of how a business process operates. Differences between student SRTs provided a useful basis for classroom discussion. First, small groups of students created a consolidated SRT that improved on their individual work. Several teams reported their results, and other teams were asked to comment. Differences between the various groups' SRTs generated an interesting discussion of how one identifies the scope of a system.

A subsequent group assignment due during the seventh week of the undergraduate course asked students to identify a real world work system they were familiar with, summarize it using an SRT, identify and estimate the current numeric value of metrics, and identify possibilities for improvement. Most student teams had little difficulty using SRTs to summarize provider and customer activities. However, many teams said little about metrics other than speed (i.e., the average duration or cycle time of specific steps). The latter shortcoming was partly related to the undergraduates' lack of business experience, although prior assignments from many MBA and even EMBA students revealed related difficulties in identifying more than the most obvious metrics when attempting to describe or analyze system-related problems.

At the end of the semester both undergraduates and MBAs will submit group assignments that use service responsibility tables and other tools to perform a more complete analysis of an IT-reliant work system from a business viewpoint. (Detailed examples from the pilot testing to date are not available because the courses are not yet completed. Requesting permission to publish student responses before the end of the semester might cause problems related to grading.)

Conclusion

The attempt to take co-production of services seriously led to the development of a new tool that seems to be easy to use, flexible, and readily applicable to a wide range of situations. While the initial results are encouraging, formal testing is needed in order to verify that the tool is readily usable by business generalists.

Difficulty in communication between business and IT professionals is a crucial problem in analyzing, designing, implementing, and improving systems in organizations. Given that UML and other tools for IT professionals are often difficult for non-expert analysts to use effectively (Erickson and Siau 2004; Bolloju and Leung 2006), those tools are inappropriate for use by most business professionals. Initial results for generalist students suggest that SRTs might become a useful tool for developing a preliminary understanding of IT-reliant work systems from a business viewpoint, and for discussing the scope and nature of a system that is to be analyzed and improved.

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