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Disentangling Service: Using a Work System Perspective to Reconcile Different but Overlapping Portrayals of Service and Service Systems

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Note: This draft is a working document. It will be improved based on feedback.

Abstract. Discussion and debate about the meaning of service, service system, IT service, and related to terms has proven inconclusive and frustrating. This preliminary draft provides insights about the nature of the problem and tries to disentangle ideas and expectations related to three portrayals of service. In a nutshell, efforts to understand service as a unitary concept tend to go in circles due to overlapping references to different but overlapping portrayals and contexts. This paper identifies three separate but somewhat overlapping portrayals of service, services as acts, services as outcomes, and services as software entities. Then it introduces a work system perspective on service to explore whether and how the three portrayals of service can be reconciled.

This paper proceeds in layers. The first layer introduces three portrayals of service and cites examples to show that one or several of those portrayals is present in most published definitions of service. The second layer introduces the main ideas in work system theory (WST) as a summary of a work system perspective on systems in organizations. The third layer explains how a work system perspective provides a path for seeing the relationship between the three portrayals of service. The fourth layer answers a number of specific questions related to the ideas in the first three layers.

This sequence might seem like a long slog, but it ultimately shows that the important point is not an individual definition of service or some other term, but rather a system of concepts that makes sense as a whole and that applies to most practical situations.

Layer 1: Three Portrayals of Service

The everyday language of systems and services has become convoluted because terms such as system, service, service system, IT service, value, capability, and function have different meanings in different contexts, and sometimes have different meanings in the same discussion without anyone noticing.

Different portrayals. Table 1 shows two portrayals of service as applied to the same situations. Viewing service as acts is basically a provider's portrayal. This portrayal implies that the focus should be on whether and how acts are performed. Viewing service as outcomes is basically a customer's portrayal. This portrayal implies that the important issue is the outcome that is attained and the extent to which that outcome facilitates value for customers. That is more of a customer viewpoint because customers care more about outcomes than about the acts that produced or facilitated those outcomes.

Table 1. Services as acts versus services as outcomes

Situation	Service as acts	Service as outcomes
Documentation service	The telecommuting technical writer analyzes software, decides how to explain it, and writes documentation.	Availability of documentation produced by the technical writer
Software development service	The IT group interviews stakeholders, analyzes the situation, proposes requirements, and builds the software.	Availability of software produced by IT group
Call center	The call center answers the call, does a preliminary analysis, and escalates the call if necessary.	Incident resolution facilitated by the call center.
Training department	The training department sets up appointments, analyzes user knowledge, and provides person-to-person training and testing.	User's attainment of a particular level of understanding as a result of the training

In all four IT-related examples, the people performing the service have guidelines but need to use judgment to understand the situation and figure out what to do to produce or facilitate the appropriate outcome.

A third portrayal of service that is common in IT has completely different expectations and connotations:

> A service "is generally implemented as a course-grained, discoverable software entity that exists as a single instance and interacts with applications and other services through a loosely coupled (often asynchronous), message-based communication model." (Brown et al, IBM Systems Journal, 2005)
>
> "The component that consumes business services offered by another business component is oblivious to how the provider created the business service." (Cherbakov et al, IBM Systems Journal, 2005)

A person trying to perform service based on expectations for a software service entity would seem ridiculous because that would involve acting mechanically without any use of judgment. A software service entity trying to act like a person would be unreliable at

best because we don't know how to model human judgment in unanticipated situations that test the bounds of whatever knowledge went into the software.

Service offerings. Regardless of which portrayal is used, services may or may not live up to the "service offering" that led to the service acts, service outcomes, or triggering of the software entity. A service offering or value proposition is a service provider's proposal about future acts that will lead to future outcomes, as in "We will resolve 95% of incidents within 3 hours." In reality, the proposed acts may or may not be performed consistent with the proposal, and the actual outcomes may or may not satisfy the expectations in the service offering.

Past Definitions of Service

For current purposes it is worthwhile to note past definitions of service, but not necessary to explain detailed rationales for each of those definitions. Table 2 gives examples of the many definitions of service that have been proposed. (Most of these definitions were cited in Alter (2012)) A glance at the definitions shows that they reflect fundamentally different viewpoints. Some definitions focus more on acts performed by service providers, some focus more on outcomes perceived by customers, and some are about software entities that are meant to be invisible.

Table 2. Three different portrayals emphasized in past definitions of service

Portrayal	Definition
acts	"an act or performance that one party can offer to another that is essentially intangible and does not result in the ownership of anything." Kotler and Keller (2006, p. 402)
acts	"intangible activities customized to the individual request of known clients." Pine and Gilmore (1999, p.8)
acts	"a provider-client interaction that creates and captures value." IBM Research (2009)
acts	Sampson and Froehle (2006, p. 331) defines service as situations in which "the customer provides significant inputs into the production process."
acts	"value-creating support to another party's practices. Grönroos (2011, p. 285) As suggested by Normann (2001), this support may either relieve customers from taking on some task or enable them to do something that otherwise would not be possible to accomplish or would be accomplished less efficiently or effectively."
acts	"the application of specialized competences (knowledge and skills) through deeds, processes and performances for the benefit of another entity or the entity itself." Vargo and Lusch (2004, p. 2)
acts	"Acts performed for the benefit of others" (Alter, 2012) For totally automated services, acts performed by one entity to satisfy needs of another entity.
outcomes	"a change in the condition of a person, or a good belonging to some economic entity, brought about as a result of some other economic entity, with the approval of the first person or economic entity." Hill (1977, p. 318)
outcomes	"a time-perishable, intangible experience performed for a customer acting in the role of a co-producer." Fitzsimmons and Fitzsimmons (2006, p.4)
outcomes	"a simultaneous or near-simultaneous exchange of production and consumption,

	transformation in the experience and value that customers receive from engagement with providers, and intangibility in that goods are not exchanged." Rai and Sambamurthy (2006, p.328)
software entity	A service "is generally implemented as a course-grained, discoverable software entity that exists as a single instance and interacts with applications and other services through a loosely coupled (often asynchronous), message-based communication model." (Brown et al, 2005) "The component that consumes business services offered by another business component is oblivious to how the provider created the business service." (Cherbakov et al, 2005)

Instead of assuming that particular definitions are right or wrong, it is more useful to assume each definition makes sense from a particular viewpoint or in a particular context. A definition of service and service system by someone thinking about hospitality situations such as hotels or restaurants probably will not emphasize the same topics as a definition of service by someone thinking about international transportation of goods, water supply systems, software testing, or web services. It is possible to go a bit deeper by looking at the circularity in the three portrayals of service.

Circularity of three portrayals of service. Figure 1 illustrates the circularity of the three portrayals of service plus several related complexities. Acts that are intended to benefit customers (the first portrayal of service) produce outcomes and affordances that are intended to benefit customers (the second portrayal of service). In the third portrayal, service software entities perform acts and produce outcomes and affordances. Meanwhile, customers may be work system participants who perform parts of the acts that benefit them (e.g., in medical exams or in self-service ecommerce). The acts can use, consume, or create resources.

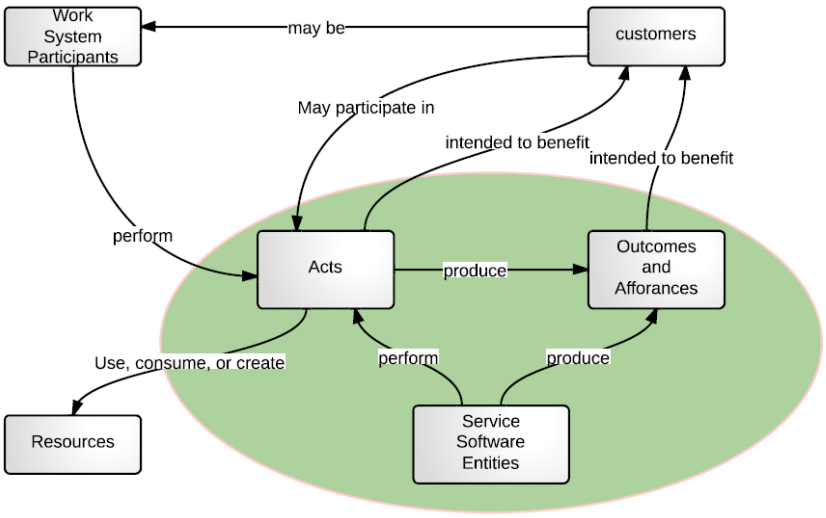

Figure 1. Circularity of three portrayals of service plus related complexities

For more clarity it is useful to look at the entire topic from a new perspective that starts outside of the discussion about definitions of service. Layer 2 introduces a work system perspective that provides a basis for looking more deeply at service and service systems in Layer 3 and Layer 4.

Layer 2: A Work System Perspective

This section starts with a summary of "work system theory" (WST). The designation of a particular set of ideas as WST is a convenient way to summarize the basic ideas in a work system perspective for thinking about systems in organizations. It also provides the foundation for a set of "extensions" of WST, two of which will be mentioned later.

Work system theory. WST encapsulates a perspective for understanding systems in organizations by viewing them as work systems. WST defines the term *work system* and describes work systems using two central frameworks. The work system framework provides a static view of a work system during a period when it is relatively stable. The work system life cycle model (WSLC) provides a dynamic view of how a work system evolves over time through a combination of planned and unplanned change. WST is a formalization of core ideas that form the basis of a flexible systems analysis method called the work system method (WSM). The goal in developing WSM was to find a way to help business professionals understand systems from a business perspective (rather than an IT perspective), thereby helping them participate more effectively in system related projects and collaborations with vendors, consultants, and IT professionals. This required a very general yet useful set of ideas for thinking about systems in organizations.

Definition of work system. A work system is a system in which human participants and/or machines perform processes and activities using information, technology, and other resources to produce products/services for internal or external customers. Enterprises that grow beyond a largely improvised start-up phase can be viewed as consisting of multiple work systems. Typical business enterprises contain work systems that procure materials from suppliers, produce products, deliver products, find customers, create financial reports, hire employees, coordinate work across departments, and perform many other functions. The basic ideas about work systems are the same regardless of whether a work system's products/services are directed internally within the firm or externally to the firm's economic customers and other external bodies such as governments or industry organizations.

Work system is a general case for which there are many special cases. Work systems are generally considered sociotechnical by default, but based on the definition can also be

totally automated systems. Sociotechnical work systems have human participants. Totally automated work systems operate autonomously and automatically after being launched. Information systems are work systems whose activities are all devoted to processing information. Projects are temporary work systems designed to produce specific products/ services and then go out of existence. Supply chains are inter-organizational work systems that provide supplies and other resources required for the operation of customer organizations.

Work System Framework. As shown in Figure 2, the work system framework is a pictorial representation of a work system in terms of nine elements included in a basic understanding of the work system's form, function, and environment during a period when it is relatively stable, even though incremental changes may occur during that period. The arrows in the work system framework are about alignment, not about input-output. Processes and activities, participants, information, and technologies are viewed as completely within the work system; customers and products/services may be partially inside and partially outside because customers often participate in the processes and activities within the work system (e.g., the patient during a medical exam, the customer during design meetings for custom-built software) and because products/services take shape within the work system; environment, infrastructure, and strategies are viewed as largely outside the work system even though they have direct effects within the work system. The nine elements are defined in Table 3.

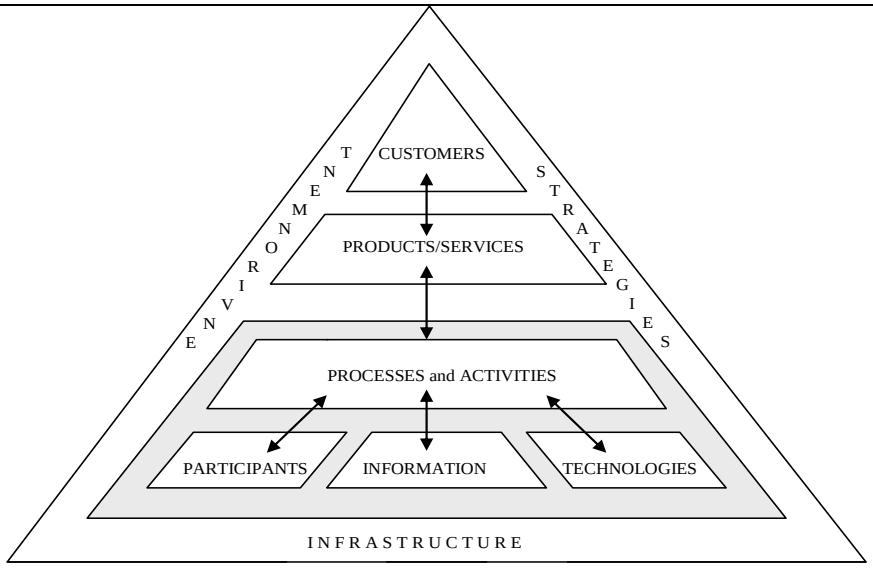

Figure 2. The Work System Framework (Alter, 2013b)

Table 3. Definition of terms in the work system framework
Customers. A work system's customers are recipients of a work system's products/services for purposes other than performing work activities within the work system. Customers of a work system may also be participants in the work system (e.g., patients in a medical exam, students in an educational setting, and clients in a consulting engagement).
Products/services. Work systems exist in order to produce things for their customers. Products/services consist of information, physical things, and/or actions produced by a work system for the benefit and use of its customers. The term "products/services" is used because the controversial distinction between products and services is not important for WST/ WSM even though product-like vs. service-like is the basis of a series of valuable design dimensions for characterizing products/services.
Processes and activities. The work performed by work system is described as its processes and activities. A work system is much more than just the business processes and activities that it contains or is supposed to perform. Explicit identification of the other eight elements in the work system framework is a reminder that the same steps might be performed with different participants, different information, and/or different technology.
Participants. Participants are people who perform work within the work system, including both users and non-users of IT. Work system participants may be customers of the work system, as happens in self-service work systems and in many service systems such as medical treatment. Designers of a work system consider capabilities, incentives, interests of a work system participants because those factors are determinants of how well the work system will operate
Information. This is informational entities that are used, created, captured, transmitted, stored, retrieved, manipulated, updated, displayed, and/or deleted by processes and activities. Typical informational entities include orders, invoices, warranties, schedules, income statements, reservations, medical histories, resumes, job descriptions, and job offers. Non-computerized information that is used or generated in the work system is also relevant for design because ignoring it will hide important factors related to work system performance.
Technologies. This includes hardware and software that are used directly by human participants, other relevant hardware and software that operates automatically after being launched by other work systems, and other technical resources.
Environment. Work system designers should consider the relevant organizational, cultural, political, competitive, technical, regulatory, and demographic environment within which the work system operates, and that affects the work system's effectiveness and efficiency. Factors in a work system's environment may have direct or indirect impacts on its performance results, aspiration levels, goals, and requirements for change.
Infrastructure. This is the relevant human, informational, and technical resources that are used by the work system but are managed outside of it and are shared with other work systems.
Strategies. The success of a work system depends in part on the enterprise strategy, organization strategy, and work system strategy. Strategies at any of the three levels may not be articulated or may be inconsistent with reality or with beliefs and understandings of important stakeholders.

The work system framework does not differentiate between products and services, thereby avoiding confusion about the difference between products and services. Instead,

it says that products/services are the outcomes and affordances produced by a work system for its customers. Most products/services combine some degree of characteristics that are generally associated with products (e.g., related to outcomes or affordances, physical or informational form, persistence over time, reliance on specifications, etc.) and some degree of characteristics that are generally associated with services (e.g., embodied in performances or acts that are experienced, intangibility, consumed as produced, customized, produced in response to requests, etc.)

The interesting question is not whether something is a product or service. The interesting question is about the positioning of a product/service in relation to a number of design dimensions that go from more service-like to more product-like. Typical design dimensions of this type include more co-creation versus less co-creation, more customized versus less customized, more intangible versus less intangible, more customer interaction versus less interaction, more responsiveness versus less responsiveness, and so on. Ideally, the design of the work system should determine the position of its products/services along those dimensions based on appropriate trade-offs between variables such as internal cost of operating the work system, total cost to the customer, customer satisfaction, job satisfaction of work system participants, and so on.

The work system framework also bypasses confusion and disagreement about whether services must be or should be co-produced, co-created, interactive, etc. From a work system perspective, the extent of co-production, co-creation, interactivity, and other such characteristics are design decisions that are determined based on the preferences of customers, work system designers, managers, and work system participants.

Work System Life Cycle Model. The other central framework in WST is shown in Figure 3. The work system life cycle model (WSLC) expresses a dynamic view of how work systems change over time through iterations involving planned and unplanned change. The WSLC represents planned change as projects that include initiation, development, and implementation phases. Development involves creation or acquisition of resources required for implementation of desired changes in the organization. Unplanned changes, represented by inward-facing arrows, are ongoing adaptations and experimentation that change aspects of work systems or work system projects without separate allocation of significant project resources. For example, the inward facing arrow attached to the operation and maintenance phase is typically about small work system changes that do not require formal projects or allocation of significant resources. The inward-facing arrow for that phase can also represent emergent changes in practices or goals that occur over longer periods without conscious planning. Inward-facing arrows for development and implementation phases of formal projects represent emergent changes in intentions, designs, and plans based on new insights and knowledge after the initiation phase.

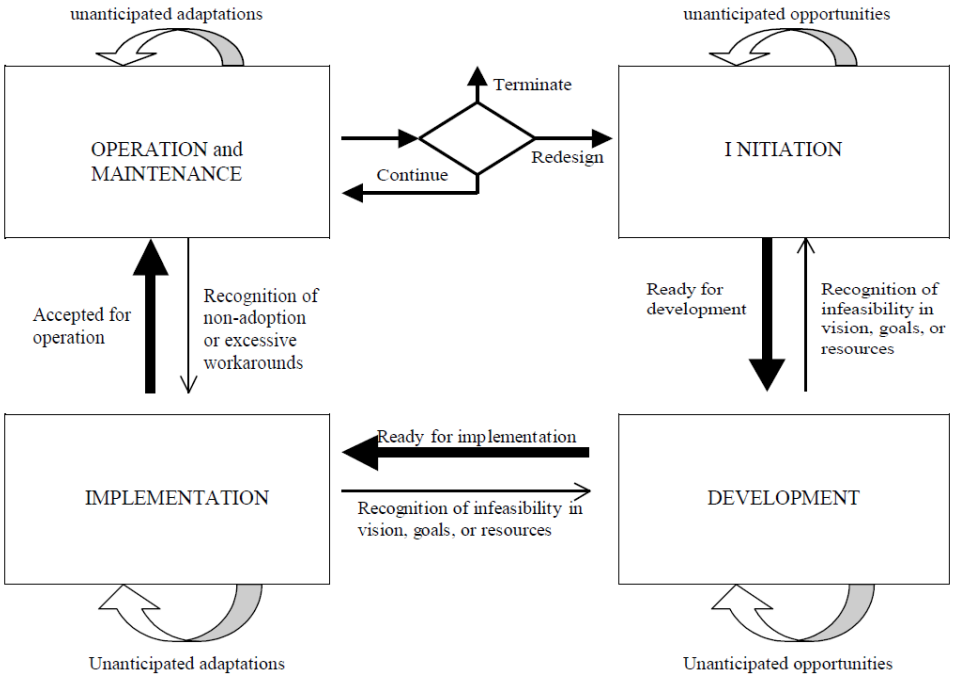

Figure 3. Work System Life Cycle Model (Alter, 2013b)

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

Work System Method. WSM is a flexible system analysis and design method that is based on WST. It treats the system of interest as a work system and builds on the two central frameworks in WST. WSM was created for use by business professionals, and can be used jointly by business and IT professionals as part of the initial analysis for designing work system improvements that may or may not involve producing software. It can be used for high-level guidance in thinking about a work system or can organize a relatively detailed analysis through use of a work system analysis template. WSM was originally developed as a straightforward application of general problem solving that started from whatever work system problems, opportunities, or issues launched the analysis. The most notable aspect of WSM in relation to other analysis and design

methods is that the "as is" and "to be" systems are work systems with human participants rather than configurations of hardware and software that are used by users.

WSM starts by identifying the smallest work system that has the problem or opportunity that launched the analysis and design effort. The analysis phase creates an overview of the work system using a tabular form called a work system snapshot. This is a formatted one page summary of a work system based on six elements: customers, products/services, processes and activities, participants, information, and technologies. The analysis phase also compiles performance gaps related to important metrics for the work system and its elements. Depending on the user's goals and capabilities, the analysis may also include flowcharts, scatter plots, rate of diagrams, control charts, discussions of key incidents, discussions of customer concerns, and other factors that should be understood before making a recommendation. The design phase is the creation of the recommendation. Since the recommendation is about a proposed work system, the summary of the recommendation includes proposed changes and a work system snapshot of the "to be" work system. The justification of the recommendation explains why proposed changes should result in better work system performance and why the benefits of the changes outweigh the effort of making those changes.

The nature of WSM is quite different from the nature of a reference model. A reference model defines the desired structure of a system based on best practices or other considerations. The WSM provides general guidelines about steps in deciding how to improve a work system regardless of whether it conforms to reference models or documented best practices (if available, these could be inputs to the decisions)

Layer 3. Applying a Work System Perspective on Systems in Organizations to Visualize More about Three Portrayals of Service

Figure 4 shows how a work system perspective helps in visualizing different portrayals of service. The work system and everything to its left in the diagram is fundamentally about a supplier's view of service production. The right side of the diagram is fundamentally about customer's view of service consumption. The question in the lower left about how SOA might improve things is basically a computer science portrayal. Many other factors that could have been included in Figure 4 will be included in Figure 5, which will look at work systems in more depth.

All three portrayals of service appear in the diagram. The "acts view" of service occurs in the activities within the work system that are for the benefit of the work system's customers. The customer activities that create value for the customers themselves are not considered services because they are not directed at someone else. The "outcomes view"

of service occurs in the products/services that are produced by the work system, in the service level agreement (which specifies outcomes rather than acts), and in the related facilitation of value for the customer. The "software entity" view occurs in the lower left, where service orientation is a modularization strategy to achieve joint optimization (i.e., appropriate trade-offs) involving various aspects of the work system's operational performance and desired agility, resilience, and scalability.

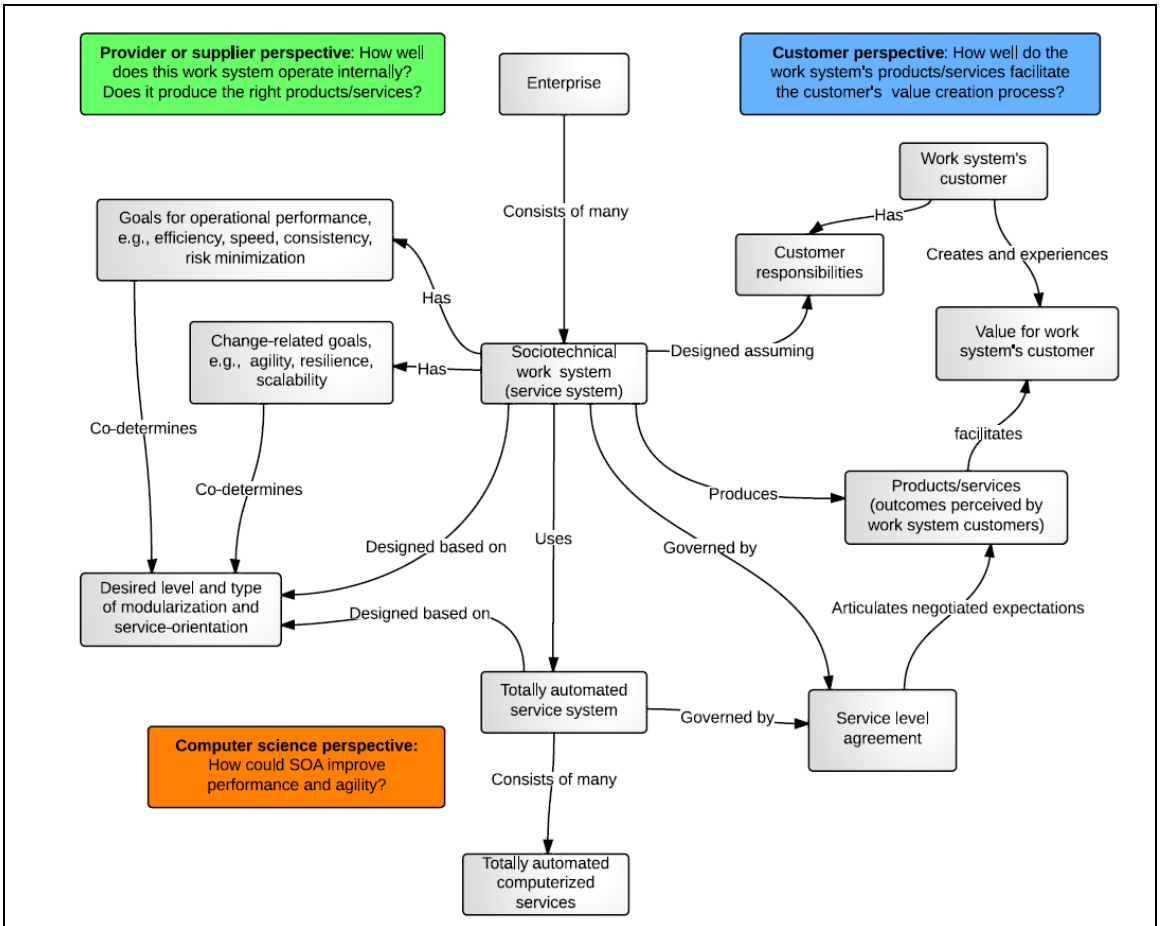

Figure 4. Using a work system perspective on systems in organizations to visualize three portrayals of services

Here is what Figure 4 says:

- Enterprises consist of many work systems, almost all of which are service systems. . (Service systems produce products/services for the benefit of someone else.)
- Work systems produce products/services. Thus, at least some of the activities within the work system are acts performed for the benefit of the work system's customers. Work systems produce products/services (outcomes) that facilitate value for the customers of the work system. (As will be shown by Figure 5, systems also produce products/services that are used internally by other activities within the work system.)

- Value for work system's customers is created and experienced by those customers. Value is not created by providers. For example, if someone does legal work for me, regardless of how much I pay for that work the value of that work for me depends on how my activities use that outcome or affordance.
- Value co-creation is optional. Value may be co-created if activities within the work system coincide with value creating activities performed by the customer. (This point is controversial in the service science community.)
- The work system's customers have customer responsibilities in relation to the operation of the work system. Those responsibilities may involve performing activities within the work system (i.e., coproduction activities) or may involve other responsibilities such as contributing to the economics of the work system or simply not interfering with the operation of the work system.
- The products/services produced by the work system are governed by negotiated service level agreements. Meeting those service level agreements implies that the work system is partly governed by the need to satisfy those service level agreements. It is also partly governed by other factors such as production costs, labor rules, and management intentions.
- The design of the work system is based partly on the desired level and type of modularization, which may be realized through service-oriented architecture (SOA).
- The desired level and type of modularization is determined partly by goals for operational performance such as efficiency, speed, consistency, risk minimization, and is determined partly by change-related goals involving agility, resilience, and scalability. Issues about performance and changeability are relevant for any work system regardless of whether IT is involved.

All of the above leads to the conclusion that no single definition of service is adequate for all of the contexts within which service is discussed. Definitions that try to combine acts with outcomes may be adequate in some situations (e.g., music performances or fine dining) but are inadequate in other situations (e.g., construction or repair of physical things that will be used in the future). The SOA view may help in some situations, but won't help in largely manual work systems that are loosely structured.

The above comments answer some questions a superficial way and leave others unaddressed. Before looking at those questions in a fourth layer we will mention two extensions of WST that help in answering those questions.

Work system metamodel. Figure 5 is the latest version of a work system metamodel that outlines a more detailed operational view of a work system than is provided by the work system framework. The work system framework is useful for summarizing a work system and achieving mutual understanding of the scope and nature of a work system, but is less effective as a tool for detailed analysis. The metamodel is more complete and precise

about concepts required to support deeper analysis without requiring terminology (e.g., objects and classes) that is impenetrable to most business professionals.

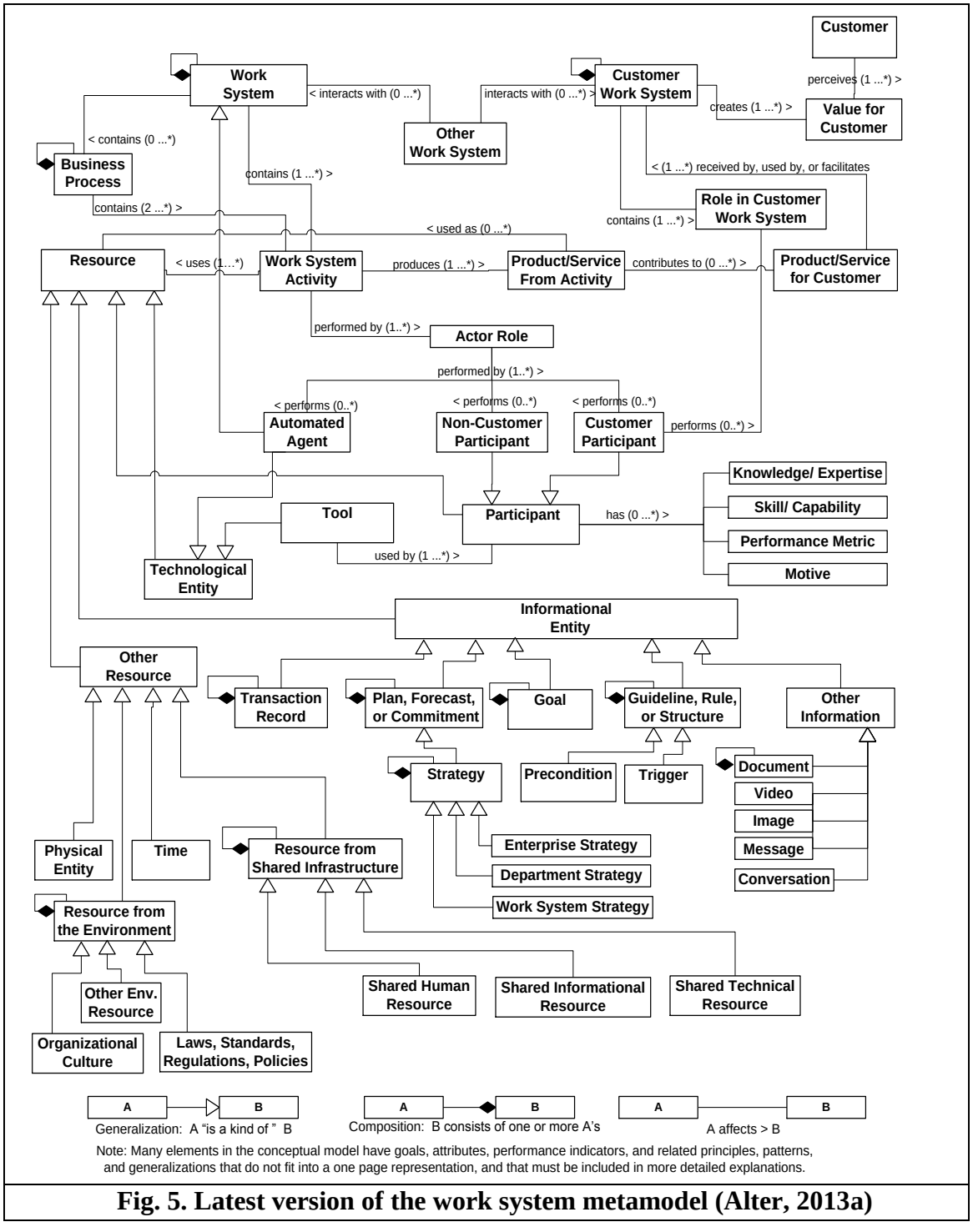

Fig. 5. Latest version of the work system metamodel (Alter, 2013a)

The metamodel builds upon the work system framework by making its concepts clearer and more useful in work system documentation and software development. This creates a

potential bridge between a summary level description of a work system and more detailed models as the work system is decomposed into subsystems during analysis and design. When used in conjunction with additional attributes such as characteristics, metrics, and principles for specific elements, it can support traceability between summary level analysis by business professionals and more detailed analysis and documentation by IT specialists.

The metamodel says that a work system may contain one or more business processes but must contain one or more work system activities (otherwise it does not do anything.) It says that work system activities are performed by actor roles, and that roles can be performed by three types of actors: customer participants (e.g., users who provide input related to incidents or desired software capabilities), noncustomer participants (e.g., IT professionals who are analyzing incidents or producing software), or automated agents (which are totally automated work systems on their own right).

Each element of the work system framework is represented in the metamodel, although most are re-interpreted in a more detailed way. For example, information becomes informational entity of which many types may be relevant, technology is divided into tools and automated agents, activities are performed by three types of actors, and so on. Whereas the work system framework does not include the term *user*, the metamodel includes "uses" as a relationship between a participant and a tool (which is one of two guises of technology). Representation decisions in the metamodel try to maximize understandability while revealing potential omissions from an analysis or design process. Figure 5 hides a large number of important attributes such as characteristics, metrics, and principles that apply to specific elements and relationships in the metamodel. Analysts using the metamodel would consider and apply the hidden attributes while defining the problem or opportunity, evaluating the "as is" work system, and justifying proposed improvements that would appear in the "to be" work system.

One of the new features of this latest version of the metamodel is that it covers all three portrayals of service. In relation to the first two portrays, it includes acts that are performed (the work system activities) while also including the outcome-related issue of how and where value is created. It says that work system activities use different types of resources (various human, informational, technological, and other resources) to produce products/services that may be resources for subsequent activities within the work system and/or may be products/services for customers. Products/services for customers are received and used by customer work systems that create value for customers.

This metamodel also contains a place for totally automated services (the third portray of service). One of the three types of actor roles is "automated agent." The upward arrow from automated agent to work system says that an automated agent is a type of work system on its own right. When using the metamodel to decompose a sociotechnical work

system, it is likely that automated agents will be isolated at various points. Since those subsystems are work systems, they can also be described using the same ideas, such as resources used and products/services produced. The only general difference is that an automated agent has no participants.

Based on the above, the metamodel in Figure 5 provides a much more detailed view of the ideas in Figure 4. The metamodel manages to include all three portrayals on service in the same diagram while also providing details for analyzing and designing the work system.

The metamodel also addresses the definitional question of whether value is necessarily co-created and whether services always involve co-production, ideas that are repeated frequently in the service science literature. Based on the relationships between the entity types in the metamodel, value is co-created when value-creating activities in a customer work system coincide or occur in close proximity with work system activities in a provider work system. Products/services are co-produced when customer participants play actor roles in work system activities in the provider's work system. Those particular work system activities may or may not be directly related to value for the customer. For example, providing information that helps the provider with its own internal recordkeeping or billing processes may have little direct impact on creating value for a customer.

Theory of workarounds. The discussion of the inward-facing arrows in the WSLC noted that emergent change in operational work systems occurs when workarounds, adaptations, and local experimentation lead to new practices. Although the WSLC identifies where emergent changes occur, it does not say much about mechanisms through which they happen. The theory of workarounds goes beyond the WSLC by explaining mechanisms through which workarounds occur in operational work systems.

The theory of workarounds illustrated in Figure 6 provides a lens for understanding how emergent change actually occurs. The theory was developed to describe how and why workarounds are created. It covers most types of workarounds and most situations in which workarounds occur in a large number of examples in the literature related to operational systems of many types, including medical systems, factory systems, administrative systems, and sales systems. It is based on a broad definition of workaround that clarifies the preconditions for the occurrence of a workaround and also covers most of the more limited definitions of workaround in the literature. A workaround is a goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system in order to overcome, bypass, or minimize the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system

or its participants from achieving a desired level of efficiency, effectiveness, or other organizational or personal goals.

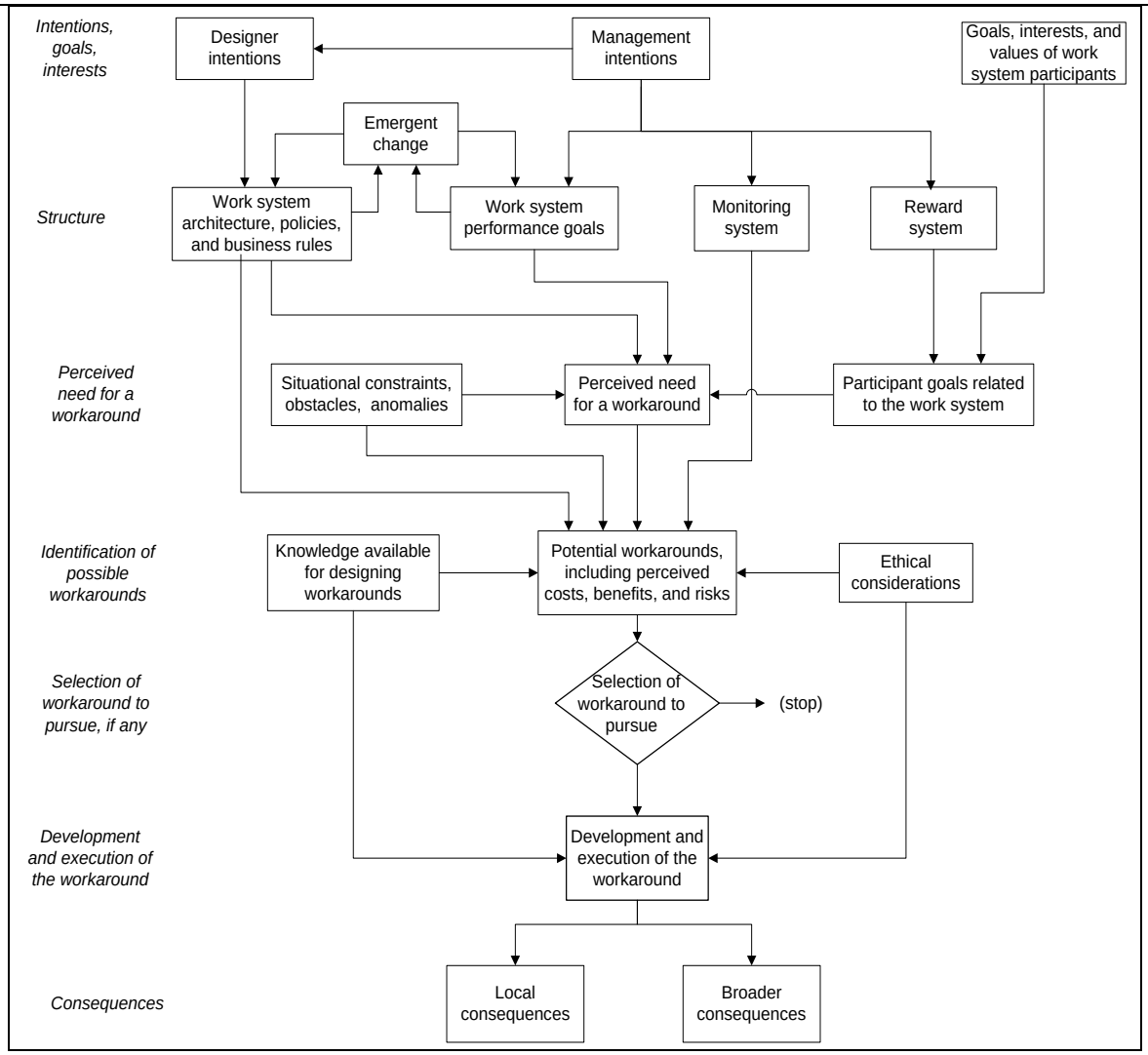

Fig. 6. Theory of Workarounds (Alter, 2014)

Italicized terms on the left side of Figure 6 identify generic steps in perceiving the need for a workaround and then creating it. The sequence reflects a basically rationalist view in which work system participants create workarounds by identifying obstacles and deciding what to do about them. The first two steps reflect the context within which emergent change occurs. Specific emergent changes are developed and executed through a typical problem solving process that includes perceiving the need for a change, identifying possible changes, selecting a change to pursue (if any), developing and executing the change, and finally, reaping the consequences.

The theory of workarounds is relevant to all three portrayals of service because it highlights issues related to whether services will be carried out in accordance with best practices, service level agreements, management intentions, or any other guidelines that can be imagined. A service that always will be performed in exactly as specified or intended is quite different from a service that may be performed in different ways depending on obstacles and contingencies perceived and addressed by work system participants. Using the theory of workarounds to inspect many service systems will probably find that both work system activities and work system outcomes are subject to many workarounds that should be considered to the extent possible in the initial design and ongoing reviews.

Layer 4: Questions Answered by a Work System Perspective

Below are a number of questions related to service, service systems, IT services, and other concepts that can be addressed by using the work system ideas from the previous layers.

Which of the three portrayals of service is best? Tables 1 and 2 provided a basis for recognizing three portrayals of service, services as acts, services as outcomes, and services as software entities. Each portrayal is useful in specific contexts. A shortcoming of both "services as acts" and "services as outcomes" is that each of those portrayals emphasizes something that may or may not be important to important stakeholders. Providers may care greatly about doing the work efficiently but may or may not care greatly about whether the customer's receive the maximum benefit (regardless of whether an outside observer believes that should be the only appropriate attitude).Customers who receive benefit from the outcomes and affordances that a work system produces may care greatly about how production occurred or may not care about that in any significant way. The computer science portrayal of service is fine for service software entities, but does not describe the operation or outcome of sociotechnical work systems in which human participants perform work and exercise judgment within the constraints and variability of human capabilities. No one has produced a definition of service that is best in all three contexts simultaneously.

When IT groups use the term services it sometimes is not clear whether they are referring to sociotechnical work systems, totally automated work systems, or both as though they are the same kind of entity. While the work system framework (Figure 2) and the work system metamodel (Figure 5) can be used in both cases, the operational expectations for these two cases are quite different. Sociotechnical work systems bring human variability, brilliance, and discretion, which can be essential in some cases and problematic in others. Totally automated work systems operate mechanically, which leads to consistency that may be problematic when confronted with unanticipated errors, obstacles, or contingencies.

After all of the above, what does service actually mean? From a work system perspective, having a "one size fits all" definition of service is not fruitful because each of the three portrayals of service is useful in specific contexts. Accordingly, a work system perspective says that work systems produce products/services for use within the work system and/or for the direct benefit of their customers. A work system perspective purposefully ignores the distinction between products and services because that distinction is not helpful for analyzing or designing systems. At the same time, a previously mentioned series of design dimensions based on characteristics often associated with products versus characteristics often associated with services is quite useful for analysis and design.

From a provider viewpoint, services are acts performed for the benefit of someone else. From a customer viewpoint, products/services for customers are outcomes and affordances that are intended to be beneficial for customers. In almost all economically significant situations those products/services are created by work systems rather than by total improvisation or accident. Those customers may be internal customers (within a firm) or external customers (the firm's economic customers).

What is an IT service? An IT service can be defined in many different ways depending on the purpose and context. An IT group can say that all of its work systems are IT services that produce specific outcomes or affordances. Alternatively, it can say that the outcomes and affordances resulting from all of its work systems are IT services (e.g., examples in Table 1). It can also say that each of its independent software entities is a service. The point of confusion is when two or more of those definitions of IT service are used in the same IT group or when people from different IT groups try to communicate when using different definitions of IT service.

What is the difference between a work system and a service system? A service system is a work system that produces products/services for someone else. Almost all economically significant work systems are service systems because the division of labor in organizations is based on various groups of people making different, but coordinated contributions to the overall effort. The exceptions, work systems that are not service systems, e.g., work systems such as private data systems or modeling systems that a knowledge worker devises for personal benefit (not for a customer's benefit), sometimes because the organization's information systems are not helpful enough and sometimes because of personal motives that

may or may not be consistent with the organization's goals.

What is a service life cycle? That depends on the definition of service and the definition of life cycle. If a service is a sociotechnical work system or totally automated work system, then the WSLC (Figure 3) says that its life cycle is an iteration involving planned and unplanned change in the various elements of that work system, e.g, the processes and activities, participants, information, and technologies. If a service is a single instance of the start to finish execution of a software entity, then the term life cycle might be used to describe the activities that are performed from start to finish. That could easily cause confusion in relation to business processes, which flow from a starting point to an end point and often use totally automated services along the way.

How is all of this related to business models? A business model is a terse summary of how a business serves its customers and interacts with partners and suppliers in order to generate enough revenue to operate. Businesses operate through work systems. Every business that gets beyond a start-up phase contains many separate work systems that all need to operate individually and need to coordinate with other work systems. Various forms of enterprise architecture summaries are intermediate points between business models and descriptions of specific work systems within a business.

How is all of this related to IT groups? IT groups operate through a series of work systems, each of which can also be viewed as a service system. For example, the IT Value Chain framework developed by the IT4IT Consortium (2013) identifies four value streams for IT groups, strategy to portfolio, requirement to deploy, request to fulfill, and detect to correct. Each of those value streams consists of a number of functions that can be viewed as work systems because each of those functions involves human participants and/or machines performing processes and activities using information, technology, and other resources to produce products/services for internal or external customers. Examples of functional components of "strategy to portfolio" include IT architecture management, policy management, and demand management. Examples in "requirement to deploy" include project delivery management, requirements management, and change management. Examples in "request to fulfill" include catalog management, subscription management, and deployment management. Examples in "detect to correct" include service monitoring, problem management, and change management.

What is the relationship between work systems, capabilities, and functions? Once again, this depends on what is meant by capabilities and functions. If a firm has a work system that performs incident management, then it clearly has an incident management capability, and one might also say that it has an incident management function. Names such as work system, capability, or function reveal nothing about the power, efficiency, or consistency of that entity. It is clearer to say that a firm has an incident management work system (or capability or function) that operates in a particular way (that might be defined using many different tools, methods, and metamodels) and that has exhibited certain levels of performance and certain performance gaps in relation to specific measures of performance. Furthermore, that work system has certain characteristics related to capacity, resilience, reliability, and other issues that can be described based on the details in tools, methods, and metamodels such as WSM and in the work system metamodel.

What does value mean in relation to services? Just as service has different definitions and connotations in different situations, value has completely different meanings when approached from different viewpoints. In accounting and operations management, value added is the dollarized resources used in a production step or across a production process. From that viewpoint, value is measured by an accumulation of resources used and is expressed in relation to actual or standard cost. In management and operations, a value chain is a set of steps that each transforms outcomes or work-in-process from previous steps to make it more valuable to end customers, regardless of what the steps happen to cost. In Six Sigma, value stream mapping is the identification of value adding and non-value adding steps. In finance and economics, the value of something is its market value. In some applications, it is a reference value such as par value of a bond. From a marketing viewpoint, value is determined by the customer, not the producer, and refers to something that the customer cares about regardless of how much it costs. Since all of these interpretations are appropriate in some service-related situations, all of these views of value are applicable in at least some discussions of services.

Isn't it true that services are defined as having certain characteristics, such as intangibility, impermanence, consumption at the time of production, co-production, co-creation of value, etc.? The simple answer is that the concept of service has been defined in different ways, as shown in Table 2. Some of those definitions are based on characteristics such as intangibility, impermanence, consumption at the time of production, co-production, and co-creation of value. Other definitions are not based on those characteristics. Definitions that might be helpful for some types of situations might not be helpful for other types of situations.

Does this clarify the difference between IT resources and IT service systems? This is a question of viewpoint. It is possible to assume that IT groups have resources that are called IT resources and that an IT group's work systems can be called IT service systems. It is also possible to assume that any resource that is directly related to IT is an IT resource, regardless of whether it is used or owned by an IT group. From a work system perspective neither term adds clarity in general even though either term can be part of the local language of a particular IT organization. The work system metamodel does not distinguish between IT resources and not-IT resources. Instead, it says that every work system activity uses resources that may be various types of human, informational, technological, and other resources.

How is all of this related to ITIL and ITSM? An expert on ITIL and ITSM terminology would have to make that call. Both cover a set of work systems. If their terminology is sufficiently well defined, it should be possible to interpret ITIL and ITSM systems in work system terms. Whether that would be useful depends on the clarity of ITIL and ITSM.

What is self-service? Self service occurs in a work system in which a customer is a primary participant who uses resources that the provider makes available. For example, self-service purchase of books occurs when customers participate in a book purchasing work system whose website is provided by the vendor.

How is all of this related to service dominant logic (Vargo and Lusch, 2004, 2008)? The marketing and service science communities have focused a lot of attention on SD-logic since it was first presented in 2004, building on previous streams of economic research. SD-logic was first published in the *Journal of Marketing* and is basically about the nature of economic exchange and competition. Its name comes from the claim that the goods-orientation that dominates traditional marketing and economic analysis and methods should be supplanted by service-orientation (in an economic sense). SD-logic says little about operational aspects of services, which is relatively clear from comparing the work system framework and work system metamodel with the 8 foundational premises of SD-logic in Vargo and Lusch (2004) and the 10 foundational premises in the revised version in Vargo and Lusch (2008). A possible test of whether SD-logic contributes significantly to understanding IT services or ITSM is to explore whether its ten premises provide significant insights about work systems in the four value streams in the IT value chain framework described in *IT for IT Reference Architecture* (IT4IT Consortium, 2013), such as IT architecture management, change management, incident

management, and configuration management.

To what extent are considerations related to economic exchange essential for understanding the operation of service systems? All service systems that exist in economic enterprises, whether for profit or not for profit, need to be paid for in some way. The details of of payment activities or other types of exchange are important for understanding the operation of some service systems but not for others. For example, payment is a highly visible part of the operation of most restaurants and retail stores. On the other hand, payment for public education, police, medical, and governmental systems may be far removed in time, location, and administrative responsibility from the operational activities that determine whether such services are provided efficiently and effectively. Price is an important consideration for automatic selection of automated services from a catalog. On the other hand, the detailed execution of a service instance may be unrelated to the price.

How is all of this related to the trend toward domination of the economy by service industries? It is not related at all. Enterprises in all sectors of the economy -- agriculture, mining, manufacturing, and service -- operate internally through work systems that are service systems and serve their external customers through work systems that are service systems. In other words, SIC code has nothing to do with whether an enterprise produces services. Economic trends toward increasing emphasis on service vs. goods have led to many important service and service system innovations. Most of those innovations are basically the creation or improvement of work systems and therefore can be analyzed using the same ideas that can be used to analyze any work system.

Does the use of SOA imply that an enterprise is service oriented? Figure 4 says that SOA is a modularization approach that applies to totally automated service systems. The fact that a enterprise's computer systems use SOA does not imply that the enterprise is a service oriented enterprise (SOE). To decide whether an enterprise qualifies as an SOE requires a definition of SOE. An SOE might be an enterprise that is subdivided into modules that act and interact as though they were software modules. It seems unlikely that that could happen in most enterprises because most groups of people don't like to act like software modules even though they make extensive use of software when they do their work and even though they may benefit greatly from the flexibility and scalability of SOA designs in that software. On the other hand, SOE might be a plausible concept if it means that different parts of an enterprise define their interdependencies carefully and coordinate extensively based on well-defined dependencies and commitments.

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