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Abstract
This paper presents a new, operational view of service activities and service systems in the form of an extension of the resources-for-action (RA) section of an existing service system metamodel. The original metamodel represented the fact that service activities need resources in order to occur and also produce products/services that are resources for subsequent service activities and/or the service system's customers. The new RA section clarifies the different types of resources that are created or used by service activities within service systems. This paper addresses an area of service science that is not well-developed. The literature related to service science tends to treat resources in a general and nonspecific manner that provides relatively little insight about how to identify specific resources that are needed or used in specific service systems. This paper combines ideas from two streams of research, one related to a service system metamodel and the other related to a new tool for systems analysis and design. After summarizing a new extension of the RA section of the service system metamodel, it uses an example related to service activities in a medical clinic to illustrate how the new RA section leads to a tabular documentation, analysis, and design tool. That tool can be used for examining the design or operation of a service system with emphasis on the timely availability of necessary resources.

Keywords: service science, service system, resource integration, resources-for-action, service system metamodel, work system

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RESOURCES FOR ACTION: A RESOURCE-BASED VIEW OF SERVICE SYSTEMS

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ABSTRACT

This paper presents a new, operational view of service activities and service systems in the form of an extension of the resources-for-action (RA) section of an existing service system metamodel. The original metamodel represented the fact that service activities need resources in order to occur and also produce products/services that are resources for subsequent service activities and/or the service system's customers. The new RA section clarifies the different types of resources that are created or used by service activities within service systems.

This paper addresses an area of service science that is not well-developed. The literature related to service science tends to treat resources in a general and nonspecific manner that provides relatively little insight about how to identify specific resources that are needed or used in specific service systems. This paper combines ideas from two streams of research, one related to a service system metamodel and the other related to a new tool for systems analysis and design. After summarizing a new extension of the RA section of the service system metamodel, it uses an example related to service activities in a medical clinic to illustrate how the new RA section leads to a tabular documentation, analysis, and design tool. That tool can be used for examining the design or operation of a service system with emphasis on the timely availability of necessary resources.

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RESOURCES FOR ACTION: AN OPERATIONAL VIEW OF RESOURCES IN SERVICE ACTIVITIES AND SERVICE SYSTEMS

NEED FOR A DIFFERENT RESOURCE-ORIENTED VIEW OF SERVICE

The literature related to service science tends to treat the important topic of resources in a general and nonspecific manner. The related management and strategy literature often discusses resources at a highly aggregated level under headings such as a resource based view of the firm or of the nature of competitive advantage (e.g., Barney 1986, 1991; Hamel and Prahalad 1994). That literature focuses on how a firm's competitive advantage is related to its access to specific resources that are difficult for its competitors to obtain because those resources are rare, expensive, or difficult to create or imitate. Within the literature most directly associated with service science, service dominant logic (Vargo and Lusch 2004, 2008) treats resources as a central topic, distinguishes between operant and operand resources, and sees resource integration as essential to value co-creation. Other parts of the service science literature tend to mention resources in a general way that provides relatively little insight about how to identify specific resources that are needed or used in specific service systems.

This paper presents a new, operational view of service activities and service systems in the form of an extension of an existing service system metamodel (Alter 2011b, 2012). The current paper extends a large section of the previous metamodel that deals with resources for action. To differentiate between the entire service system metamodel and the newly revised section of it, we designate the newly revised section as the RA (resources and activities) section. The original metamodel represented the fact that service activities need resources in order to occur and also produce resources that have effects on and/or are used by subsequent service activities and/or by the service system's customers. The new RA section clarifies the different types of resources that are created or used by service activities within service systems. As will be illustrated through an example, the new RA section can be applied as the basis of a straightforward tabular tool for identifying resources used and created by each of the activities within a service system. Thus, the metamodel does not focus on firms as a whole or on the nature of competitive advantage. Likewise, it is not concerned with broad generalizations about resources, such as "resources are essential for the operation of any service system."

Extension of recent research. This paper combines ideas from research related to service systems and research related to systems analysis and design. It builds directly on two recent ICIS papers (Alter, 2010a, 2011b) and a subsequent paper in *Service Science* (Alter, 2012). The latter paper uses an interorganizational medical billing example to illustrate how a proposed service system metamodel can be applied in guiding the description of practical service situations at three levels: the value constellation, the service system, and the service activity. Overall, that paper argues that leading service science researchers may have settled prematurely on service dominant logic (SD logic) as the basis of service science. While the SD logic worldview deals with fundamentals of economic exchange and competition, its focus and level of analysis are distant from everyday operational issues of service system analysis, design, and innovation. The practicalities of creating and managing service systems require careful attention to this much more granular level of analysis. Service science cannot address many practical issues related to specific systems unless it says a great deal about that level of detail. The extension of the service system metamodel provides a way to fill in some of those details.

The new RA section of the metamodel was inspired by a stream of research about systems analysis and design in which Alter and Bolloju (2012) proposed a work system front end to object-oriented systems analysis and design. (Service systems are work systems.) Alter and Bolloju (2012) showed how a stylized summary of a work system called a work system snapshot (Alter, 2006, 2008) can lead to a more detailed specification that includes preconditions, triggers, and post-conditions of each activity within the work system. Subsequent reading found an observation by Giddens (1984) that rules and structures are resources for action. The new RA section combines ideas related to preconditions, rules, and structures in order to be more explicit about the resources that are required for the operation of any specific service activity.

A straightforward tabular tool based on the new RA section can be used to identify resources that are produced and/or used by specific activities within a service system, thereby providing a detailed, resource oriented view of the activities within a service system. That type of tabular representation is translatable into information generated by service blueprinting (Bitner et al. 2008). An important difference is that the tabular representation applies to many situations and types of service where service blueprinting would not be used. The tabular representation also can be used as a tool supporting parts of the translation from a high level description of a service system in the form of a work system snapshot (Alter, 2006, 2008) into the level of detail that appears in common types of UML diagrams used by IT professionals.

Alter (2011b, 2012) explained the original service system metamodel in its entirety. Because this paper is limited to eight pages, it focuses on the new RA section of the metamodel and on resources that are used and created in service activities. In the future a longer paper will explain the entire extended metamodel including parts that are omitted here for the sake of brevity, such as the service system's environment, infrastructure, and strategies, value constellations to which it belongs, and other service systems with which it interacts.

Organization. A brief section defines service and service system and mentions comments in the literature concerning resources and resource integration. The RA section of the extended metamodel is summarized. An example related to service activities in a medical clinic illustrates how the new RA section leads to a tabular documentation, analysis, and design tool that can be used for examining the design of the service system with emphasis on the timely availability of necessary resources. The discussion and conclusions identify implications related to a number of topics in service science.

SERVICE, SERVICE SYSTEMS, AND RESOURCE INTEGRATION

Service. Many of the definitions of service in the service science literature are listed and discussed in Alter (2011b, 2012). This paper uses a simple definition of service for reasons explained in Alter (2010b, 2012). Its simple, dictionary-like definition of service is "Services are acts performed for others, including the provision of resources that others will use." To provide symmetrical treatment for human and automated services for people and services performed by one automated entity for another (such as web services), a more general version of the definition is "Services are acts performed for other entities including the provision of resources that other entities will use." Consistent with Grönroos (2011), co-production/co-creation of value is viewed as an optional feature rather than as a defining characteristic of service in general.

Service system. As with its view of service, this paper uses a simple and very general definition of service system. A service system is a work system that produces services, i.e., that performs

acts for others, which may include producing physical things, information, and/or other things of value. All work systems that produce something for the benefit of others are viewed as service systems whether or not economic exchange is involved. That definition can be contrasted with a number of definitions of service systems that are discussed in Alter (2010b, 2011b, 2012).

Resources and resource integration. A table summarizing a revised version of the foundational premises of SD logic (Vargo and Lusch 2008, p.7) mentions resources in relation to four of the revised foundational premises, FP1, FP4, FP7, and FP9. In combination, the comments in that table say that the application of operant resources (knowledge and skills), "service," is the basis for all exchange; that operant resources are the fundamental source of competitive advantage; that enterprises can offer their applied resources for value creation and collaboratively (interactively) create value following acceptance of value propositions, but cannot create and/or deliver value independently; and that all social and economic actors are resource integrators.

A sociological perspective on resource integration and value co-creation (Edvardsson et al. 2012) asks, "How can we theoretically explain what enables and constrains resource integration and value co-creation?" (p. 82) It says that "as resource integration and value co-creation take place within a service system, all beneficiaries, including the customer, the employees, the company, and the other actors, become resource integrators and value co-creators in a complex joint endeavor" (p. 86). Also, "intended and actual resource integration may vary, and this 'variation' may exert a negative or a positive impact on the outcome." (p. 91)

The generality and abstractness of the above comments about resources and resource integration. is quite appropriate for theorizing about services and resources, but may not prove helpful for managers and analysts trying to understand, analyze, and improve specific service systems. The goal of the improved service system metamodel is to provide useful guidance for those purposes.

This perspective on resources is totally different from Barney's resource based view of the importance of resources. According to the Encyclopaedic Dictionary of Strategic Management, Firm resources are generally quite loosely defined, tending to include everything internal to the firm. Barney (1986) lists all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. as resources. So, if resources can be anything internal to the firm, what ones are more strategically important? Barney (1991) has put forward a popular checklist for this. He identified the following as the key characteristics for a resource to be strategically important:

- Valuable – There is no point having a resource if it does not deliver value to the firm.
- Rare – Resources that are owned by a large number of firms cannot confer competitive advantage, as they can not deliver a unique strategy vis-à-vis competing firms.
- Inimitable – Resources can only be sources of sustained competitive advantage if firms that do not possess these resources cannot obtain them.
- Non-substitutable – There must be no strategically equivalent valuable resources that are themselves neither rare nor inimitable.

While resources can be purchased, it is generally argued that to achieve strategic advantage from a resource it needs to be developed internally. As "deployment of such [tradable] assets does not entail a sustainable competitive advantage, precisely because they are freely tradable" (Dierickx & Cool, 1989). Internal development of resources, however, can take long periods of time and is often unclear how to proceed. In a sense it is this uncertainty, opaqueness and development

duration that adds to the potential sustainability and value of the resource once it is developed.

The view of resources in this paper is not directly related to strategic advantage. Instead it focuses on operational issues by outlining the different types of resources that may be required in order to perform specific activities within a service system in an organization. The customers of that service system may be internal or external customers.

Resource-based view of a service system. Contrary to the resource based view of competitive advantage, a resource based view of service systems simply assumes that resources are essential for the operation of a service system. Where Barney (1991) says that resources that affect sustainable competitive advantage are valuable, rare, inimitable, and non-substitutable, resource in an RBV of a service system may have any or none of those characteristics. In fact, if resources for a service system are valuable, rare, inimitable, and non-substitutable, a prudent manager may try to move toward resources that are less valuable, less rare, less inimitable, and potentially substitutable. Instead, the following can be said about resources in an RBV of a service system:

ideally inexpensive - so that the service system will not be too expensive
ideally common - so that it will be easy to obtain required resources from multiple sources
ideally substitutable - so that a shortage or supply breakdown can be worked around
ideally imitable - except where the inimitability of a resource makes a great difference to customers

These everyday resources are of a number of types:
informational entities: including entities stored in databases and other informational entities
technological entities: including tools and automated agents
human participants:
other resources:

Some of those resources are inputs to the service system. Other resources are produced by steps within the service system and consumed by subsequent steps in the service system.

THE "RESOURCE FOR ACTION" SECTION OF A REVISED SERVICE SYSTEM METAMODEL

This paper focuses on an improved "resource for action" (RA) section of the service system metamodel presented in Alter (2011b, 2012). That metamodel is part of a stream of research that started with an attempt to support more detailed analysis than is afforded by the work system framework (Alter 2006, 2008). The work system framework is effective as the basis for preliminary analysis of service systems, but is less effective as a tool for more detailed operational analysis. Each element of the work system framework is represented in the metamodel (identified by using gray backgrounds for those specific entity types), although most are re-interpreted in a more detailed way.

Figure 1 presents the revised RA section, which focuses on identifying specific resources that are needed for specific service activities within service systems and on resources that are produced

by those service activities. Its purpose is to support the description, analysis, design, and evaluation of specific service activities and service systems. The RA section says:

- Service systems may or may not contain processes (defined sequences of activities) but they must contain at least one activity. (Otherwise they doesn't do anything.)
- Activities are performed by one or more actor roles, which may be played by customer participants, non-customer participants, and/or automated agents.
- Activities always use one or more resources and always produce one or more products/services. Those products/services may be resources for subsequent activities within the service system and/or may provide value or enable value co-creation by customers (who may be customer participants in the service system).
- The resources used may include pre-conditions (including triggers), rules or structures, informational entities, technological entities, (human) participants and other resources.

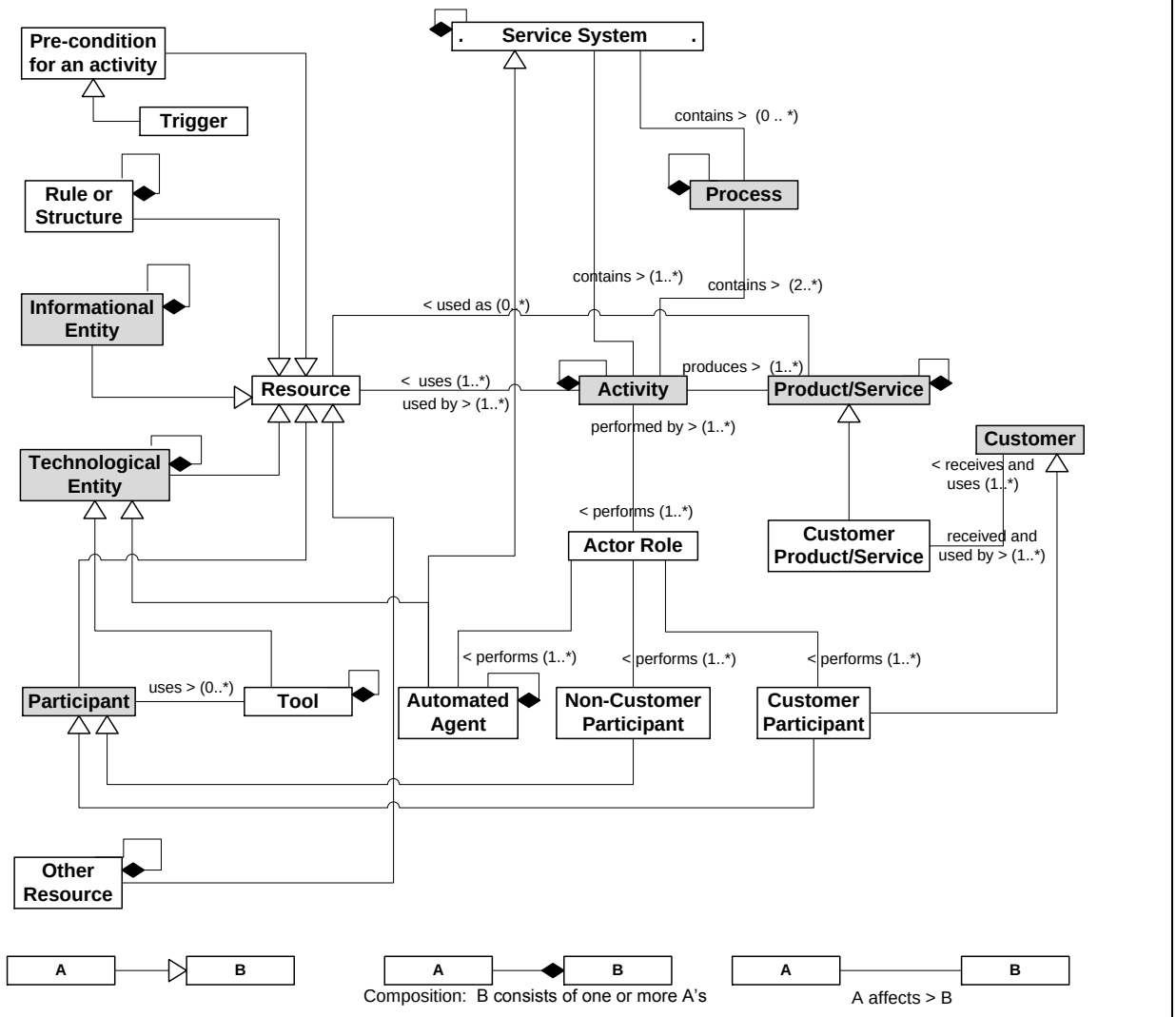

Figure 1. The "resource for action" (RA) section of an extended service system metamodel

The categories of resources identified in Figure 1 are more useful for operational analysis than simple dichotomies in the service science literature, such as human vs. technical resources or operant vs. operand resources. Although informational resources, technological resources, and human participants are unsurprising categories, it may seem surprising to consider pre-conditions, triggers, and rules or structures as resources for action. They are included for several reasons. First, activities usually should not occur if their pre-conditions are not present (even though activities sometimes occur regardless of pre-conditions due to oversights, accidents, software bugs, workarounds, and unanticipated contingencies or responses, a point similar to how Edvardsson et al. (2012) differentiates between intended and actual resource integration). Activities that have a specific trigger (a type of pre-condition) are supposed to be initiated when the triggering condition occurs. Giddens (1984) said that rules and structures are resources for action. In the metamodel, those rules may be formal business rules tailored to service system

specifics (e.g., a person doing task X must be have qualification Y) or may be formal rules in the surrounding environment (e.g., rules for using corporate computer networks). Similarly, structures may be informal rules of behavior within the surrounding culture or may be explicit policies. "Other resources" include any resource worth mentioning that is not included in other categories. Examples include office buildings, furniture, roads, air conditioning, clean water, and other resources that are often taken for granted even though their absence can cause difficulties.

Note that entity types in Figure 1 have numerous attributes that that might be shown in a more detailed representation, such as multiple goals, characteristics, metrics, and relevant principles that cannot be displayed in a one-page representation but could be included in a computerized representation. For example, attributes of a participant include various types of knowledge and skills, level of motivation, and incentives. An informational entity's attributes related to size, form, coding scheme, precision, and accuracy depend on the type of information.

EXAMPLE ILLUSTRATING A RESOURCE-FOR-ACTION VIEW OF SERVICE ACTIVITIES AND SERVICE SYSTEMS

A straightforward medical example in Table 1 illustrates the value of the RA section of the revised service system metamodel. This example is inspired by a service blueprint of a medical initial treatment process in Menschner et al. (2011), although it describes a process that is more familiar to the author. Table 1 illustrates the type of operational view that is required to clarify specifics that must be understood in order to create and maintain an efficient and effective service system. Table 1 contains a row for each activity in the service system. The column headings are related to entity types in Figure 1. For each activity it shows rules and structures, participants, preconditions, triggers, information used, technologies used, other resources used, information created, updated, or deleted, other products/services produced, and other post-conditions. Similar tables can be produced by treating each activity as a subsystem, i.e., a separate service system summarized using the same type of table. The detailed flow of logic (e.g., forks and joins) can be represented as conditional activities or as subordinate subsystems.

The entries in Table 1 seem unremarkable, yet they actually reveal many issues that must be addressed for efficient operation and effective service provision by the medical clinic. For example, the entry under rules and structures in the cell for recording information from the patient visit ("focus on checkboxes; avoid providing long commentaries") raises important questions about the quality and usefulness of the information in the electronic medical record system. The trigger for bringing patients to examining rooms recognizes that informal coordination is extremely important, and cannot be replaced by totally automated scheduling tools. The entry for technology used in providing a prescription notes two possible methods. One might wonder why prescription pads are still used and if an electronic prescription system is

Service activity	*Rules and structures*	*Participants (actors)*	*Preconditions*	*Trigger*	*Information used*	*Technology used*	*Other resources used*	*Information created, updated, or deleted*	*Other products/ services produced*	*Other Post-conditions*
Check in patient at front desk	No non-emergency patients after 5:00 PM.	* Patient (or parent), * Front desk staff	Patient appointment or walk-in	Patient's arrival at front desk	Appointment log	Appointment scheduling software	Reception area and waiting room	Patient arrival at front desk	* Explain wait time expectations	Patient seated in waiting room
Bring patient to examining room	Avoid interactions with other patients.	* Physician's assistant or nurse, * Patient	* Examination room ready, * Timely availability of medical staff	* Examination room ready, * Timely availability of medical staff	* Examination room ready, *Appointment schedule of medical staff	Appointment scheduling software	Informal, coordination-related observations and decisions	Patient in examining room	* Provide instructions, * Explain wait time expectations	Patient waiting in examination room
Check vital signs (heart rate, etc.) and ask questions	Do not give medical advice to a physician's patients.	* Physician's assistant or nurse, * Patient	Patient waiting in examination room	Informal, coordination-related observations and decisions	* Patient medical record * Medical knowledge	* Medical technology, e.g., heart rate monitor	Examination room	* Vital signs * Observation of patient * Patient comments	* Answer patient questions prior to physician's examination	Patient waiting in examination room
Perform examination and/or medical procedures	Discourage return visits to minimize cost per patient.	* Physician or nurse practitioner, * Patient	Patient waiting in examination room	Informal, coordination-related observations and decisions	* Patient medical record * Medical knowledge	* Medical technology relevant to patient's condition	Examination room	* Medical provider's understanding of patient's condition	* Information for patient *Extension of relationship with patient	Patient ready to get dressed and leave examination room
Record information from patient session	Focus on check boxes. Avoid providing long commentaries.	* Physician or nurse practitioner	Start of patient session	Medical observation that should be recorded	* Patient medical record * Medical knowledge	* Paper medical record and/or electronic medical record system	Examination room	* Updated medical record of patient * Billing information for session		* Medical record available * Billing information available
Provide prescription	Justify any use of non-generic drugs that are more expensive than generics.	* Physician or nurse practitioner * Patient	Completion of medical examination/ procedures	Medical condition requiring prescription	* Patient medical record * Medical knowledge	Prescription pad or electronic prescription system	* Knowledge about insurance and related issues	Prescriptions	* Advice to patient about prescriptions, other matters	Patient responsibility to obtain and use medicine, and to follow medical advice
Create follow-up appointments	Schedule 2 patients per slot.	* Front desk staff * Patient	Patient at front desk, ready to leave	Patient at front desk, ready to leave	Calendars of patients and providers	Appointment scheduling software	Informal conversation	Appointments	* Answer patient questions	Patient responsibility to return
Patient payment and check out	Encourage immediate payment.	* Front desk staff * Patient	Patient at front desk, ready to leave	Patient at front desk, ready to leave	Services rendered by medical staff	* Computer * Billing software	* Clinic's network	Payment transaction	* Answer patient questions	* Payment or arrangements resolved

Table 1. Activity-Resource Table for Patient-Centered Activities in a Medical Clinic

fully operable. Issues such as those must be dealt with in an operational analysis or design effort aimed at creating or improving this service system. No amount of theorizing about the nature of service in general, the nature of competition, and other nonoperational topics will bring these very practical questions to the foreground.

DISCUSSION AND CONCLUSION

The RA section of the extended metamodel contributes to service science because this level of operational detail is essential in practice, helps in clarifying the nature of other resource-related contributions to service science, and may provide a basis for research in a number of areas.

Covering internally and externally directed service systems. The entire extended metamodel is equally valid for service systems directed at internal customers and/or external customers. That is why the metamodel says nothing about economic exchange or the nature of competition. In contrast, SD logic and other theorizing related to service systems comes from a marketing and economics tradition that focuses on marketing to external customers. The distinction in scope is important if service science covers internally directed and externally directed service systems.

An operational approach to resources. The "resource for action" (RA) view of service activities and service systems has a different purpose than much recent theorizing about resources and resource integration, which tends to be quite general and abstract. Although the RA section of the extended service system metamodel is definitely general and abstract, it supports a practical need of identifying specific resources required for specific service activities and resources produced by those service activities. However, despite differences in emphasis, there is a link between the RA view and more general statements about resources and resource integration. Applying the tabular compilation in Table 1 across a service system's activities and related resources leads to identification of the resources needed by and produced by that service system. Aggregating further across multiple service systems within an enterprise might help in identifying key resources related to differentiation or competitive advantage for that enterprise. Thus, although an RA view is not oriented toward theorizing about the nature of competition, it might help in organizing empirical data that tests the validity of generalizations about service-related resources and resource integration.

Exploration of service science concepts. Tabular service system summaries like Table 1 can be used to explore the meaning and usefulness of service science concepts such as operant vs. operand resources and resource integration. In relation to operand versus operant resources, the example in Table 1 contains many resources of both types, including patients who are both operand and operant resources because they are acted upon and also provide knowledge and insight related to their own situation. The two guises of technology in the metamodel - as tools used by participants and as automated agents that operate autonomously - demonstrate operand and operant roles of technology. In relation to resource integration, Table 1 raises a question about what the concept of resource integration adds to basic concepts about system design. Table 1 can be explained without using the term resource integration. It is not clear what resource integration actually adds to the understanding of the situation, other than the relatively obvious fact that the service providers have to figure out how to use the resources that are available in order to produce services (actions for others) efficiently and effectively, possibly including co-creation of value (which is optional, as mentioned earlier).

Supplementing or augmenting service blueprinting. The RA section says nothing specific about service blueprinting, but covers many of the basic concepts, such as the five components of a service blueprint (Bitner et al. 2008): customer actions, onstage contact employee actions, backstage contact employee actions, support processes, and physical evidence. The metamodel treats customer actions as activities performed by customer participants. It treats onstage and backstage contact employee actions as activities performed by non-customer participants. Physical evidence is reflected in information created by that step. Concepts such as the line of interaction, line of visibility, and line of internal interaction can be inferred in some situations but not in others. Specific activities that have both customer participants and non-customer participants would typically be above the line of the interaction in a service blueprint. Most entries in Table 1 are above the line of visibility because the patient sees the physical environment and clinic personnel while checking in, sitting in the waiting room, moving to the examining room, interacting with medical staff, and returning to pay the bill. Aspects of internal interactions such as coordinating the use of examining rooms also appear in Table 1. Although service blueprints for relatively simple service situations are easy to visualize, tabular summaries in the form of Table 1 have a number of advantages for more detailed analysis and design efforts because they identify many topics that are not evident in service blueprints.

Static versus dynamic views of service systems. The entire extended metamodel provides what is essentially a static view of the service system, i.e. a view of how that system operates during a particular period of time when its form and scope are not changing rapidly. Although the topic of how service systems arrive at their current form and scope is beyond the scope of this paper, is important to mention that topic briefly. The work system theory that is the basis of the service system metamodel includes a work system life cycle model (Alter, 2006, 2008) that encompasses both planned and unplanned change. It was extended in the direction of services *per se* through a service value chain model (Alter, 2008, 2010b) that starts with negotiations about the terms, conditions, and expectations for a proposed service and includes onstage and backstage service activities. Many other approaches to service system evolution have been proposed, including the sociological approach in Edvardsson et al. (2012), which was mentioned earlier. It applies ideas from structuration theory (e.g., signification, legitimation, domination) to theorize about how one set of value propositions comes to dominate another. Further research about how service systems arrive at their current form and scope is important, but is beyond this paper's scope.

A step toward realistic simulation of proposed service systems. The inclusion of preconditions, triggers, rules and structures, and other entity types in the RA section of the metamodel provides the basis of agent-based simulation of proposed service systems. For example, an agent-based simulation could start with initial conditions and could apply the elements of the RA section to identify essential elements of a detailed simulation. No research has been done yet to explore the practicality of that approach.

Links to UML. Eventually most service systems need software support. The RA section and Table 1 extend previous research related to translating from relatively high level work system (service system) summaries to detailed specifications of the type used for software development. Continuation of that research calls for application to a diverse set of service systems.

Limitation. This paper presented the RA section of the extended service system metamodel and used Table 1 to illustrate how the entity types in the RA section can be used directly in a tabular analysis and design tool. It did not provide an empirical demonstration that that way of thinking or that tool generate better results in practice. This is a topic for future research.

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