Chapter 1
Social Value: A Service Science Perspective

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Abstract This chapter provides an analysis of the concept of social value from a service science perspective. Social value is a concept of great interest to governments, foundations, nonprofits, and corporate social responsibility organizations and a central focus of many policymakers. Service science is an emerging transdiscipline for the (1) study of evolving service system entities and value co-creation phenomena and (2) pedagogy for the education of twenty-first-century T-shaped service innovators from all disciplines, sectors, and cultures who may become social value generators through cross functional engagements. A bridging framework for social value (as calculated by social entities) and individual value (as calculated by individual entities) is presented along with some future research directions.

Keywords Service science • Social entities • Social value • Transdiscipline • Value co-creation

1 Introduction: Motivations and Goals

What is social value? This chapter provides a definition and analysis of social value from a service science perspective. As we will come to see, social entities are collectives built up from individual entities in a nested, networked fashion. To begin, we consider an example of social value in the wild.

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When geese and other migrating birds fly in V-formation, trailing birds benefit from the extra effort of the goose upfront or leader. The lead goose is efficient. As the leader becomes exhausted, a natural rotation of leadership occurs where the strongest and best positioned moves into the leadership role. How many generations of evolution of migratory birds were needed to create the genetic and behavioral patterns for this aerodynamic collaboration? What role did competition and predators play pruning the weaker trailing birds, allowing this unique form of collaboration to emerge?

In the evolution of human groups, a leader is also often efficient, who can make a way to make things run more quickly and smoothly when there are difficult choices. When no single right choice exists for individuals, leaders select a best choice—the choice of compliance, following or obeying the leader. A leader thinks of self and thinks of group well-being and often benefits most from the health and survival of the group. However, what about groups without leaders, how do they operate, and what are the pros and cons of leaders?

Let's try to answer our first question. What is social value? How can we compare the social value of leaders to the social value of such things as literacy or money? Does scale (population size) and level (*knowledge burden*[1]) matter a lot or a little? Social value is arguably created by any number of evolved or designed solutions to human challenges and opportunities. It includes social capital as well as the subjective aspects of well-being, such as their ability to participate in making decisions that affect them and others.

To answer these questions further a broad perspective on human history is needed. Service science, which is an emerging transdiscipline, provides one such broad perspective. A transdiscipline borrows from existing disciplines, without replacing them. Like any emerging science, service science provides a new way of thinking and talking about the world in terms of measurements on entities, interactions, and outcomes, but also adds diverse symbolic processes of valuing (Spohrer et al. 2011; Spohrer and Maglio 2010). Specifically, a service scientist seeks to measure the number and types of entities, interactions, and outcomes, in order to advance better methods, processes, and architectures for thinking, talking about, and shaping the world in terms of nested, networked service system entities and value co-creation phenomena, including their diverse processes of valuing (Spohrer et al. 2012). These concepts (service systems, value co-creation, processes of valuing) are rooted in a worldview known as service-dominant logic or SD logic (Vargo and Lusch 2004, 2008). In the parlance of SD logic, service systems are sometimes referred to as resource integrators and value co-creation is often exemplified in exchange. According to SD logic foundational premise (FP) 10 "Value is always uniquely and phenomenologically determined by the beneficiary." This premise

[1] The *knowledge burden* of a society (species) derives from the need to ensure that the next generation has the knowledge required to run all technological and institutional/organizational systems needed to maintain the quality of life of theirs and future generations and continue innovating, thus growing the burden (Jones 2005).

describes how the ultimate action in service exchange is in the processes of valuing is defined.

In fact, all entities, be they social entities (such as a nation, city, foundation, hospital, business, etc.) or individual entities (such as a person), each has implicit processes of valuing that they are sometimes able to make explicit and empirically evaluate against other explicit processes of valuing. Formal service system entities (as opposed to informal service system entities) can be ranked by the degree to which they are governed by written (symbolic) laws and evolve to increase the percentage of their processes that are explicit and symbolic. For example, early hunter-gatherer groups that existed before written language are a type of informal service system (social entity). However, today, modern nations have constitutions, written laws, regulations, and policies and create written reports evaluating their compliance, often further validated by external auditors. Modern service systems use information and communications technologies (ICTs) to augment their capabilities (Engelbart 1995). The augmentations create a reliance on technology (and other formal physical symbol systems), which add to the knowledge burden of society (Jones 2005). Growing knowledge with respect to ICT-related design, execution, storage, transmission, and reuse is creating opportunities for leading public and private sector organizations to configure service relationships that create extraordinary new value (Chesbrough and Spohrer 2006). More specifically, ICT provides the means to improve the efficiency, effectiveness, and innovativeness of organizations (Bardhan et al. 2010).

Often service science is framed in the context of business-to-business outsourcing services (Maglio et al. 2006; Spohrer et al. 2007). To address service design for social enterprises, refinements to the foundational concepts of service science have been proposed (Tracy and Lyons 2013). So like all early stage scientific communities, the language for talking about service systems and value co-creation phenomena continues to evolve, including approaches to incorporate the concept of social value into service science thinking (Spohrer 2009).

The emerging service science community greatly benefits from theoretical and empirical studies done by a growing number of service researchers (see Appendix). Empirical studies of the economic success of businesses that adopt SD logic have begun to appear (Ordanini and Parasuraman 2011). Some studies of social enterprises have also begun to appear (Tracy 2011; Tracy and Lyons 2013). These latter studies highlight noneconomic measures such as emotional value (e.g., reduced anxiety, increased motivation, increased self-esteem, a sense of empowerment or peace of mind) and social value (e.g., ethical sourcing) and suggest a great deal more research is needed.

The purpose of this chapter is to analyze the social value in terms of service science and provide research directions on what and how we can bridge social value and individual value.

In the next section, a short overview of social value from a conventional perspective is provided. Section 3 provides background on service science. Section 4 is an initial service science perspective on the concept of social value, and Section 5 concludes with future research directions.

2 Overview: Social Value

Psychologists have defined three kinds of individual orientations (cooperative, individualistic, and competitive) and used them as theoretical bases for many studies investigating the ways in which individuals approach, judge, and respond to others (Van Lange 1999). Van Lange (1999) conceptualizes social value orientation as that in which individuals maximize joint outcomes or maximize equality in outcomes, or both. Indeed, the leaders described in our opening section exhibit this social value orientation (Hakansson et al. 1982). However, societies are comprised of many people who have different orientations from competitive, to cooperative, to individualistic. The role of service entities such as nonprofits, governments, and funding agencies is not only to establish mechanisms to maximize joint outcomes and/or equality in outcomes but to be able to measure the resulting social value. This is a very challenging proposition when members of society have varying and conflicting systems of social values (Mulgan 2010).

The paper by Mulgan (2010) is one of the best short and practical overviews of social value from a conventional perspective. He highlights the fact that there is little agreement on what social value is even though funders, leaders of nonprofits, and policymakers are keen to measure and assess social value. The key obstacle to social value assessment is the misconception that social value is objective, fixed, and stable (Mulgan 2010). Instead, when social value is seen as subjective, changeable, and dynamic, we are more likely to be able to define appropriate social value metrics.

Mulgan (2010) notes that most people have an overly simplistic view of social, public, or civic value, which is roughly the value that national and regional social programs, foundations, nongovernment organizations (NGOs), social enterprises, and social ventures create. Over the last forty years, hundreds of competing methods for calculating social value have been created. Mulgan (2010) summarizes the pros and cons of the main approaches to measuring social value, including: cost/benefits, stated/revealed preferences, social return on investment, public/value-added assessments, adjusted quality of life/satisfaction, government accounting measures, and field-specific measures.

He also identifies several factors that explain why current measures of social value too often fail. First, value is in the eye of the beholder and cannot be assessed completely objectively. It is not possible to simply consider traditional economic principles such as supply and demand when social, psychological, and environmental factors come into play. Mulgan (2010) suggests that metrics and tools for measuring social value are useful if they help build markets, conversations, and negotiation in order to bridge between people and organizations that have needs and those that have solutions. It isn't sufficient to introduce clients and providers; an environment that encourages conversations and negotiations to take place must be created and nurtured. These environments can also help disenfranchised groups (such as homeless people, migrant workers, and people with mental illness) to have a voice in the market. These groups have social and economic needs but often do not have the resources or power to create a demand for suppliers of solutions and services.

A second factor contributing to problems with current social value metrics is the attempt to combine multiple perspectives (internal, external, and societal) into a single quantitative value. Rather than quantifying social value through a single number, Mulgan (2010) proposes a framework that can be used to rate proposals according to four dimensions concerning the concept of social value: strategic fit; potential outcomes or results; cost savings and economic effects; and risks associated with implementation of the proposal. In addition to rating the proposal on a scale of 0–5 along the four categories of value judgments, decision makers can include comments to support the ratings. Many of the judgments, ratings, and comments are made based on evidence and data available to the decision makers. The proposed framework also enables participants to include measures of the reliability of the evidence used to determine the ratings. The results of the social value judgments made using the framework are presented visually allowing multiple people to examine and question the measures. Over time, the ratings can be compared to actual social value assessments and can encourage consistency across decisions. The results can also be made public, keeping the decision-making and measurement process transparent and enabling communication across agencies.

Finally, Mulgan (2010) identifies the challenge of time as a factor contributing to the difficulty of measuring social value. For many social endeavors, value will not be realized until several years in the future and it is challenging to judge that future value against immediate costs. Using discounted rates as is done in the commercial world to value a given amount of money today according to the fact that it will be worth less in the future is not appropriate for governments and social organizations. Governments and social organizations give significant weight to the well-being of generations of society in the future so it not suitable to devalue the future social worth.

Convening stakeholders, providing a holistic view onto quantitative and qualitative points of view, making judgments (different values and processes of valuing), prioritizing issues, giving voice to the weakest in society (the disenfranchised), continuously listening and acting, managing complexity, and blending compassion with consequences are just some of the considerations. In many democracies, voters are usually willing to pay taxes for security (military, prisons, police force, and fire department), literacy (schools), infrastructure (roads, utilities), justice (courts), etc. However, other programs may be more controversial (e.g., sex education, drug treatment, homelessness, job training, housing, mental health therapy, animal rights, environmental protection). Part of the complexity is apportioning responsibilities across multiple levels—individuals, families, communities, cities, states, nations, and even continental regions such as the European Union. Another part of the complexity is the large number of cultural factors that come into play and across many hundreds of years of human history attitudes can vary dramatically.

Mulgan (2010) provides a state-of-the-art view on social value. Stepping back, a service science perspective on social value looks at how we got here. In broad strokes, a service science perspective recapitulates the evolution of our nested, networked ecology of service system entities—but before doing that let's introduce service science more fully.

3 Background: Service Science

Service science[2] draws on a great breadth of academic disciplines, without replacing them. How entities use knowledge to cocreate value is intimately tied to all disciplines, which can be thought of as societal fountains of knowledge. As disciplines create knowledge, which is woven into the fabric of society and becomes essential to maintain quality of life, that knowledge becomes part of the knowledge burden of that society (Jones 2005). What differentiates service science from all existing disciplines is that it is a transdiscipline, drawing on all and replacing none, with a unique focus on the evolution of service systems and value co-creation phenomena. Service science aspires to provide the breadth for T-shaped service innovators who have both depth and breadth of knowledge. Depth can be in any existing academic discipline, and appropriate breadth can improve communications, teamwork, and learning rates (IBM 2011). T-shaped innovators are able to bridge across disciplines applying their own knowledge depth to other knowledge areas.

A service science perspective, as we will see below, is a way of looking at the world through the lens of service science and SD logic. A physics perspective is a way of looking at the world and seeing a world of things made of atoms and forces, even though it is not possible for us to really *see* an atom. A computer science perspective is a way of looking at the world in terms of universal computing machines (e.g., physical symbol systems, Turing machines, etc.) and codes (e.g., symbols as both data and algorithms). An economics perspective is a way of looking at the world in terms of actors, supply and demand, externalities, and moral hazards. As we will see below, a service science perspective is a way of looking at the world in terms of an ecology of nested, networked service system entities and the value cocreation phenomena that interconnect them.

Human endeavors, such as sciences, build on philosophical foundations, and each science must first provide ontology (what exists and can be categorized and counted),[3] then epistemology (how we know and how others can replicate results), and finally praxeology (actions and how knowing matters or makes a difference)[4]. These three "ologies" explicitly or implicitly underlie all sciences; as humans, we seek knowledge of the world and of ourselves and then work to apply that knowledge through actions to create benefits for ourselves and others by changing aspects

[2] Service science is short for the IBM-originated name of service science, management, and engineering (SSME), since service science was originally conceived to be the broad part of T-shaped professionals that complements depth in any disciplinary area with breadth in SSME (IBM 2011). More recently service science has been referred to as short for SSME+D, adding design (Spohrer and Kwan 2009). Even more recently, service science has been referred to as short for SSME+DAP, adding design, art, and policy. The naming of a transdiscipline is especially challenging, and communities can debate pros and cons of names endlessly.

[3] New sciences may seem like stamp collecting or counting stamps to scientists in more mature sciences. For example, Lord Rutherford said, "All *science* is either physics or *stamp collecting.*" Service science is still at the stage of counting and categorizing types of entities, interactions, and outcomes.

[4] Thanks to Paul Lillrank (Aalto University, Finland) for this thought.

of what exists (e.g., service), in full awareness of our human sensory, cognitive, and motor limits—yet increasingly augmented by our technologies and organizations and augmented by scientifically and imaginatively derived knowledge, of both what is and what might be. However, all this knowing does create a knowledge burden which must be carefully managed (Jones 2005).

Quite simply, service is the application of knowledge for mutual benefits, and service innovations can scale the benefits of new knowledge globally and rapidly, but all this knowing does create a burden—including the burden of intergenerational transfer of knowledge.

Augmentation layers lead to the nested, networked nature of our world—specifically, as an ecology of service system entities. Value co-creation phenomena (service-for-service exchange) form the core of our human ecology (Hawley 1986). Value co-creation phenomena are also known as win–win or nonzero-sum games (Wright 2000). Competing for collaborators drives the evolution of markets and institutions and contributes to both their dynamism/stagnation and stability/instability (Friedman and McNeill 2013). Information technology, Internet of Things, big data, etc., are accelerating the ability of service systems to develop and continuously evolve and refine explicit symbolic processes of valuing, which further augment service system capabilities. Alfred North Whitehead, English mathematician, is quoted as saying: "Civilization advances by extending the number of important operations which we can perform without thinking of them" (Whitehead 1911, page 61). Augmentation layers, including technological and organizational augments, contribute to the nested, networked nature of our world and our knowledge burden (Angier 1998). Augmentation layers have many benefits, but they can also hide the extent of a society's knowledge burden.

The mature sciences of physics, chemistry, biology, and even computer science and economics can be used to tell a series of stories—overlapping and nested stories about our world and us. Physics describes the world in terms of matter, energy, space, and time, with fundamental forces well quantified across enormous scales to explain phenomena much smaller than atoms and much larger than galaxies. Physicists theorize and quantify to tell a story that stretches from before the big bang to beyond the end of time itself. Chemistry describes the world in terms of the elements, molecules, reactions, temperature, pressure, and volume. Geologists and climatologists, born of modern chemists, can tell the story of the birth and aging of our planet. Biology describes the world in terms of DNA, cells, and molecular machinery driven by diverse energy sources. Ecologists informed by modern biology tell the story of populations of diverse species shaping and being shaped by each other and their environments. Computer science describes the world in terms of physical symbol systems and other computation systems, codes, algorithms, and complexity. Cognitive scientists and neuroscientists are today working with computer scientists and others to propose stories of the birth of consciousness, communications, and culture in humans and prehuman species. Finally, economics describes the world in terms of supply, demand, externalities, principles, agents, moral hazards, and more. Economists theorize and quantify to tell the story of morals and markets, laws, and economies evolving over the course of human and even

prehuman history and how the world can be in balance one moment and then go completely out of balance the next (Friedman 2008; Friedman and McNeill 2013).

Service science adds to these stories. Service science is enormously practical, as national economies and businesses measure an apparent growth in services in GDP (gross domestic product) and revenue. Getting better at service innovation is the practical purpose of service science. Service science is also academic, and like the academic discipline of ecology, it is an integrative and holistic transdiscipline drawing from (and someday perhaps adding to) other disciplines. While the basis of service is arguably division of labor and specialization, which leads to the proliferation of disciplinary, professional, and cultural silos, nevertheless service science, as an accumulating body of knowledge, can add some measure of breadth to the depth of specialists. In this sense, service science is holistic and inclusive, and every individual can add to her/his breadth as she/he adopts a service science perspective and learns more about how the overlapping stories of other sciences and disciplines fit together into a whole. The nested, networked nature of our world becomes more apparent. As service science emerges we can begin by seeing and counting service system entities in an evolving ecology, working to understand and make explicit their implicit processes of valuing and their value co-creation (stable change with many win–win experiences) and co-destruction (unstable change with many lose–lose experiences) interactions over their life spans. In a simple way, the goal of service science is to catalog and understand service systems and to apply that understanding to advancing our ability to design, improve, and scale service systems for practical business and societal purposes (Demirkan et al. 2009). The growth of service economies has broad implications for the well-being, society, operation of businesses, the creation of academic knowledge, the delivery of education, the implementation of government policies, and the pursuit of humanitarian causes.

In the remainder of this section, we more fully explain the emergence of service science as an effort to integrate the work of service researchers from many disciplines, while extending that research as well through a greater emphasis on service systems and value co-creation (see Appendix). We do this by summarizing historical service research and the relationship to the emerging service science community, both the academic discipline(s) and professional association(s), service-dominant logic, service science foundational concepts, service science foundational premises, a proposed research agenda for a science of service, and some proposed extensions to that research agenda, each in turn.

3.1 Service Research History and Community

Because many disciplines study service, there is a great need for a transdiscipline like service science. A more fully elaborated history of service research can be found in Spohrer and Maglio (2010). Over two-dozen academic disciplines now study service from their own unique disciplinary perspective, and not surprising, each has one or more definitions of *service* (Demirkan and Spohrer 2010).

Because many professional associations also have service-related Special Interest Groups (SIGs), journals, or conferences, because many nations and businesses have service innovation and service offering roadmaps, because many universities have or are starting service research centers, there is a great need for a transdiscipline like service science and an umbrella professional association like the International Society of Service Innovation Professionals (ISSIP), which promotes service innovation professional development, education, research, practice, and policy. ISSIP.org is an umbrella professional association that adds value to existing professional associations with service-related SIGs, conferences, and journals as a bridge.

Just as service science draws on without replacing existing academic disciplines, ISSIP draws on without replacing existing professional associations—by design. The ISSIP community is new but growing. Professional associations are a type of service system that can be designed and evolved, within a population of other professional associations competing for collaborators. In fact, professional associations are a kind of social service system with goals to maximize joint outcomes and quality of outcomes.

Why are many academic disciplines and many professional associations turning to service as an area of focus? First, since service is the application of knowledge to create mutual benefits, disciplines and professional associations are eager to show the way in which their body of knowledge can be applied to create real-world benefits. Sciences typically choose the path of creating engineered icons to demonstrate benefits (e.g., a bridge, a new material, a genetically enhanced plant), and arts typically choose the path of creating cultural icons to create benefits (e.g., a play, a song, a fashion). We remember icons because they inspire awe and create value for diverse beneficiaries. Engineering is good for creating certain types of realities, and arts are good for expressing as well as inspiring possible realities. Service expresses mutual benefit and borrows from business, engineering, arts, design, operations, psychology, and many others as to how those benefits are manifested depending on goals and needs of the service participants.

A summary of the main branches (i.e., economics, marketing, operations, engineering, computing, informatics, systems, organizations, law, etc.) that service science draws can be found in Appendix.

3.2 Service-Dominant Logic

For most people, the notion that goods have value seems obvious. Isn't that why we pay for them? However, service-dominant logic (SD logic) (Vargo and Lusch 2004) challenges us to change the way we think about goods, value, and more.

Value is not an intrinsic property of goods. For example, a physicist would have a hard time measuring the value of a good, although the mass and other physical properties could be measured. On the other hand, a lawyer could quickly assess the value of a good (e.g., property) a client lost access to through the negligent behavior of some other actor. Common sense tells us that the *price* one pays to own or lease

goods can vary depending on market conditions and context. Common sense also tells us the price is not the value. A measure of the value runs straight into subjective customer experience. Ng (2012) talks about "worth" as a point-in-time decision about what one is willing to pay (the price) for something and value as a subjective, context-specific feeling of goodness at a later time. Customer knowledge and action can impact value realization (Auerswald 2012). For example, buying an exotic fruit, properly harvesting, transporting, storing, preparing, and then enjoying eating result in a positive value/feeling. On the other hand, if the fruit were to spoil and be thrown away, the result would be a negative value/feeling. These two examples demonstrate the way in which the customer's actions impact their experience.

SD logic is deeply rooted in a notion of value based on customer experience and outcomes, which is in turn rooted in customer knowledge and actions. By applying knowledge (e.g., eating the fruit in a timely manner versus letting it spoil) the customer cocreates value with the provider who made the fruit available to the customer just at the right time to maximize value for both of them. The customer may even store the fruit in a particular way to optimize the readiness of the fruit for a particular recipe. There is no end to how elaborate a customer's knowledge might be to realize an outcome. More and more, service innovators understand this view of active customers applying knowledge to cocreate value directly or indirectly with provider networks versus the view of passive consumers. Service innovators work to co-elevate both the provider and customer knowledge to realize more important and significant outcomes. Providers compete for customers, which is to say providers compete for collaborators.

SD logic makes an important distinction between *operand* resources and *operant* resources. The latter interact directly or indirectly to cocreate value (service-for-service exchange) and are also referred to as *actors* and *resource integrators*. Customer and provider actors are operant resources because they can apply knowledge to cocreate value. Operand resources, on the other hand, are the raw materials, tools, and information that can be used by the operant resources—if they, the actors, have the right knowledge to use them appropriately. Much of the service comes down to putting knowledge into action and then the processes of valuing the resulting experience and outcomes.

As we will see, in the parlance of service science, these actors (operant resource integrators) are called *service system entities* and can be people, businesses, universities, cities, nations, or any other entities capable of knowledge-intensive interactions based on value propositions and governed by rights and responsibilities (governance mechanisms). When operant resources interact directly or indirectly, it is both the experience and outcome of those interactions that concern service innovators.

For example, a car is not just a type of good that can be purchased and used, but a car is an operand resource that came to exist only through the interactions of many people and businesses over time, and these people and businesses are the operant resources with the capability to apply knowledge to create benefits for others and themselves. When you buy a car, you are really buying an unimaginably long series of service-for-service exchanges throughout history that led to the car. The money you use to buy a car summarizes an equally unimaginably long series of service-for-service exchanges.

To use a car as intended for transportation (to realize value) requires an operant resource (a driver) applying knowledge. Service is the application of knowledge for the benefit of others and self. To say this somewhat differently, operant resources apply knowledge to create benefits with other operant resources, directly or indirectly. According to SD logic, all goods and money are just operand resources that arise as a result of operant resources applying knowledge. So goods (or operand resources) have no intrinsic value. Instead, value resides in the experiences and outcomes of operant resources and is not something intrinsically within operand resources. While better explanations of applying knowledge and experiencing outcomes are necessary, suffice it to say SD logic provides a way to change the way we think and talk about the world and prepares us to think about service innovations more clearly—service innovators improve the way operant resources apply knowledge and experience outcomes. Service innovators design better games for the players (the operant resources); the goods (the operand resources) are props in the game. Better games raise the bar on outcomes. Some fundamental service innovations improve our ability to compete for collaborators, co-elevating our capabilities in the process.

With this background, the ten foundational premises of service-dominant logic as revised by Vargo and Lusch (2008) are:

SDL-FP1: Service Is the Fundamental Basis of Exchange
Implicit in SDL-FP1 is a definition of service as operant resources (actors) applying knowledge and skills for mutual benefits (value co-creation experiences and outcomes). Service-for-service exchange is the fundamental building block of all exchange ("I'll do this for you, if you do that for me" or more precisely "I'll put my knowledge into action for you, if you put your knowledge into action for me"). From a service science perspective, exchange is a type of knowledge-intensive value-proposition-based interaction between entities.

SDL-FP2: Indirect Exchange Masks the Fundamental Basis of Exchange
Implicit in SDL-FP2 is a definition of indirect exchange. For example, exchanges involving goods and/or money (so-called operand resources available to or derived from previous efforts of operant resources) obscure the fundamental service-for-service nature of exchange. The series of questions, "And where did that operand resource come from?" always lead back in human history to a person (operant resource) applying knowledge for mutual benefits, in some sort of service-for-service exchange. From a service science perspective, operant resources such as people and businesses have rights and responsibilities, but operand resources such as technology/things or information/ideas do not have rights and responsibilities.

SDL-FP3: Goods Are Distribution Mechanisms for Service Provision
Goods are operand resources. Well-designed goods incorporate a great deal of knowledge that may be the accumulation of the knowledge and practices of many people over many years.

SDL-FP4: Operant Resources Are the Fundamental Source of Competitive Advantage
Operant resources (e.g., people) can put knowledge into action and take responsibility for their actions. Certain people or businesses may possess unique knowledge or

capacity for safely taking on added responsibility (e.g., risk). Goods and information are operand resources, which in general are easier to copy than operant resources.

SDL-FP5: All Economies Are Service Economies
Implicit in SDL-FP5 is a definition of an economy. An economy is a population of operant resources with capabilities for exchange interactions. According to SDL-FP1, service is the fundamental basis of exchange. Therefore, all economies, hunter-gatherer, agricultural, extractive, information, etc., are based on service-for-service exchange between operant resources.

SDL-FP6: The Customer Is Always a Cocreator of Value
Implicit in SDL-FP6 is a definition of value co-creation. The customer is an operant resource and must apply knowledge in context to generate an experience and outcome. Win–win outcomes require both the customer and provider to realize benefits. It is worth noting that this concept confuses many people because they think of coproduction as a kind of physical work effort on the part of the customer. Work can be a direct physical collaboration (coproduction) or indirect cognitive/social coordination (co-creation). When I trust a cleaning service with the key to my house, and they trust me to pay them, we are co-creating value. When I stay at home, open the door, and get involved in cleaning my house with them, we are coproducing value. The value is in the experience and outcome, which can be derived from physical direct collaboration or trusted indirect coordination.

SDL-FP7: The Enterprise Cannot Deliver Value but Only Offer Value Propositions
Implicit in SDL-FP7 is a definition of value. Providers can assess the *cost* of service provision, but only the customer can assess the *value* of the experience and outcome. The customer can make a decision about the *worth* of an offer, based on the *price* and some mental simulation, expectation, or anticipation of the value. For example, even when an emergency response team is trying to rescue a person in peril, if that person does not want to be rescued, and does not comply or cooperate in the rescue, then it is more likely that the emergency response team will fail. Both the customer and the provider must agree to the value proposition and see the mutual benefit as well as the mutual responsibility. Win–win value propositions are at the heart of value co-creation interactions.

SDL-FP8: A Service-Centered View Is Inherently Customer Oriented and Relational
Provider value depends on customer value, which derives from experience and outcomes, and ability to apply knowledge. Win–win value propositions are at the heart of value co-creation interactions. Repeatable mutual benefits depend on mutual knowledge, trust, and coordination. Service innovators know that customer-to-customer interactions can scale value via word of mouth and platforms.

SDL-FP9: All Economic and Social Actors Are Resource Integrators
Implicit in SDL-FP9 is a definition of resource integrators. Operant resources are resource integrators, and they can apply knowledge to combine and configure (integrate) both other operant and operand resources. For example, a driver must know

how to drive to benefit from a car, and a student must know how to read to benefit from a book (at least for the primary intended use). All economic and social actors apply knowledge to integrate resources. Resources can be divided into three categories: market-facing resources (available for purchase to own outright or for lease/contract), private non-market-facing resources (privileged access), and public non-market-facing resources (shared access). Service system entities are economic and social actors, which configure (or integrate) resources.

SDL-FP10: Value Is Always Uniquely and Phenomenologically Determined by the Beneficiary

Implicit in SDL-FP10 is a reference to value determination as a process, unique to each beneficiary. Therefore value determination is a process unique to each subject or a subjective process. However, this does not mean that the process is random or unknowable. Culture and education can shape the process of valuing. Value realization is more than a decision (anticipatory calculation of benefits or worth). Value realization is contextual, history dependent, and uniquely determined by the beneficiary, shaped by culture and education. Building models of these processes, and the way culture and education shape them, is essential to advancing service science. Furthermore, these models could provide a foundation for theoretical service science.

Vargo and Lusch are clear that these foundational premises are only a starting point, and they have worked with many others to continue the evolution of SD logic. For example, reducing the foundational premises to a smaller number of definitions and foundational axioms has been undertaken. Four of the foundational premises (SDL-FP1, SDL-FP6, SDL-FP9, and SDl-FP10) have been shown to be adequate for deriving the others (Vargo and Lusch 2008).

3.3 Service Science Foundational Concepts

The fundamental concepts of service science should facilitate the creation of a trading zone between many academic disciplines (Gorman 2010). A trading zone invites individuals from different backgrounds with different vocabularies to communicate, share ideas, and engage in mutually productive interactions. The value of the concepts below, versus some other fundamental set of concepts, is in giving individuals easier access to ideas from many different disciplines. One branch of the service science community, sometimes known as the SSME+PAD branch, identifies ten service science foundational concepts (SS-FC1-10: ecology, entities, interactions, outcomes, value propositions, governance mechanisms, resources, access rights, stakeholders, and measures), plus an additional eighteen foundational sub-concepts.

The concepts and sub-concepts should be general enough to allow many disciplines to contribute to the creation of service science and build a better understanding of service systems and value co-creation phenomena. We describe each in turn:

SS-FC1: Ecology

Service science borrows from ecology (populations) as much as from economics (price). Ecology as a discipline is the study of populations of entities (evolving,

competing, cooperating, etc.) and their relationship to each other and their environment. Ecology as a concept is quite general and can apply to atoms in stars (stellar nucleosynthesis), animals in a forest, or nested, networked service system entities. Measurement of the number and type of entities, interactions, and outcomes is fundamental to ecology (and the ontological foundations of a new science).

Service ecology as a concept provides the fundamental way of thinking more scientifically about service system entities—they exist as populations of entities (evolving, competing, cooperating, etc.) in relationship to each other and their environment and can be counted and classified. The population of service system entities forms the service ecology. Currently, the service ecology is based on just one foundational species, humans, which have evolved formal (written/computational symbol based) service system capabilities for assigning and externalizing the rights and responsibilities of service system entities as legal, economic, and social systems (Deacon 1997).

Order of magnitude observation: An interesting observation about the human service ecology is that as the population approaches ten billion people, the estimate of the total number of formal service system entities (with legal rights and responsibilities) is less than one hundred billion entities. The ten entities per person average may be tied to the structure of society. Each person plays a role in several other service system entities, for example, since over 50 % of the world's population lives in cities, most people are part of service systems for their nation, state, and city. If they have a job, they may be part of a business or social enterprise. It is also interesting that to a first level of approximation, most people (individuals) are nested ten levels deep in service systems ((1) world, (2) continental union, (3) nation, (4) state, (5) county-metro, (6) city, (7) district, (8) community, (9) street, (10) household). The rough order of magnitude relationship may have to do with human capabilities and limitations, as well as the sustainable knowledge burden level of augmentation with technology and governance mechanisms. The observation may also be related to the life span and sustainability of businesses of various scales. Some businesses are global and operate in nearly all nations, and other businesses are local to a street or community. Service is the application of knowledge for mutual benefits and transformative service innovations scale up the benefits of new knowledge globally and rapidly.

From a service science perspective, each individual human and many collectives are service system entities. Human families are hundreds of thousands of years old, cities only about 10,000 years old, universities that have survived to today are only about a 1,000 years old, and modern businesses with professional managers arguably just 100 years old. Looking at orders of magnitude across time, it is clear that the scale (population size) and level (knowledge burden) of the human ecology has grown dramatically. As population size increases, a society can take on a larger knowledge burden. In fact, there is archaeological evidence that as human populations become isolated and shrink (e.g., land bridges to islands disappear), the level of technological and other indicators of cultural complexity decreases (Kremer 1993).

A luxury cruise ship is a good example of a holistic service system (Motwani et al. 2012). A *holistic service system* (SS-FSC1) is a type of service system entity

in the service ecology, such as a nation, state, city, university, hospital, cruise ship, and family/household, which provides whole service to the people inside the holistic service system (Spohrer et al. 2012). *Whole service* (SS-FSC2) refers to three categories of service capabilities necessary for quality of life of people inside service systems: flows (transportation, water/air, food/products, energy, information/communications), development (buildings/shelter, retail/hospitality/entertainment/culture, finance, health, education), and governance (rules that make competing for collaborators co-elevating) (Spohrer 2010). Holistic service systems can remain viable for some period of time, even if disconnected from all interactions with other external service systems for some period of time.

SS-FC2: Entities

Service system entities are the fundamental abstraction of service science (Maglio et al. 2009). A *formal service system entity* (SS-FSC3) is a legal, economic entity with rights and responsibilities codified in written laws. An *informal service system entity* (SS-FSC4) uses promises, morals, and reciprocity in place of contracts, written laws, and money (Friedman 2008). Mature, economically productive citizens of nations are formal service system entities with rights and responsibilities, but still operate as informal service systems when at home with their families. Children suing parents is an indication of the formal-informal boundary dispute/redefinition in progress.

Entity capabilities (SS-FSC5) *and constraints* (SS-FSC6) change over time. Capabilities and constraints impact the ability of entities to compete for collaborators and succeed at co-elevating forms of value co-creation. Human service system entity capabilities include physical, cognitive, and social capacity for work, including the ability to augment capabilities with technology and governance mechanisms. Human service system entity constraints include finite life span, finite learning rates (bounded rationality), and finite social networks, though augmentations change these constraints, while introducing a knowledge burden (Simon 1996; Jones 2005). Capabilities and constraints also include socially constructed rights and responsibilities, discussed below.

Entity identities (SS-FSC7) *and reputations* (SS-FSC8) change over time. Identity and reputation impact the ability of entities to compete for collaborators and their ability to succeed at co-elevating forms of value co-creation. Business service system entity identities and reputations contribute to brand and word-of-mouth marketing. National service system entity identities and reputations contribute to emigration, international student, and tourism rates. Individual human service system entity identities and reputations contribute to credit ratings and social network followers.

SS-FC3: Interactions

Measuring the number and types of interactions between service system entities is complex. *Service system entity interactions* can be well designed or spontaneous and then well or poorly executed. Also, interactions can be service interactions or non-service interactions. Service interactions are either value proposition based or governance mechanism based. Interactions that are value proposition based form networks that are both internal and external to the service system.

SS-FC4: Outcomes

Measuring the number and types of outcomes when service systems interact is complex; nevertheless, a few first-order simplifications can be made. For example, in the case of two entities interacting, a simple four-outcome model is: win–win, lose–win, win–lose, or lose–lose. Of these, only the win–win outcome is a service interaction with mutual benefits realized; nevertheless, in a nested, networked ecology of entities, even win–lose outcomes can serve a higher purpose. Beyond mutual benefits between two entities, when considering social value, we can also take into account benefits to the service ecology, other entities, and the community. In a study by Tracy and Lyons (2013) of social enterprises as service systems, social value was found to include benefits received by an entity indirectly as a result of a service interaction; that is, in social enterprises, value is realized when the client and provider interact which in turn results in social value being realized by additional entities that are not directly involved in that interaction. The entity realizing the indirect social value is sometimes a physical entity (e.g., a community or the environment) and sometimes conceptual (e.g., culture). Tracy and Lyons (2013) suggest that the social value that is realized in these contexts is value creation at a higher level.

Entities evolve in order to transform zero-sum games (competitions) that have winners and losers into larger non-zero-sum games (collaborations) in which every entity wins, creating an incentive to participate. This blended use of competition and collaboration to improve capabilities of entities is at the heart of value co-creation interactions and outcomes.

For example, the US National Football League has a series of weekly competitions (win–lose) and an annual draft that helps maintain competitive parity. This type of governance (system of rules or game) helps to keep the weekly games (win–lose) exciting and maximize fan interest and engagement, increasing revenue for teams, players, their management, and owners (win–win). Chess rankings pit near competitive parity players against each other (win–lose), making it hard to predict winners, but creating opportunities for incremental learning and improvement to get to the next ranking level (win–win).

For another example, the design of the European Union (EU), which won the Noble Peace Prize in 2012, created a continental scale service system entity (see the order of magnitude observation under SS-FC1 above) with component service system entities (nations). The design of the EU is an example of blended competition and collaboration to enhance capabilities, or value co-creation, intended to make the EU more competitive on the global stage and improve the quality of life in all component nations.

Interact-Serve-Propose-Agree-Realize (ISPAR) (SS-FSC9) is an elaboration of the simple four-outcome model with ten outcomes (Maglio et al. 2009). ISPAR includes both service and non-service interactions. Non-service interactions can either be welcomed or not welcomed, legal or not legal, and result in justice or not justice. Service interactions may not be realized if the proposal is not understood, or if it is not agreed to. Even if the proposal is understood and agreed to, the result may not be realized, and this can lead to a dispute or no dispute, which can be resolved or not resolved to the satisfaction of both entities.

Recovery (SS-FSC10) is a foundational sub-concept of great importance, especially when a series of outcomes is expected between entities over time and disputes arise when some outcomes are not realized to the mutual satisfaction of entities. Studies indicate that when a provider recovers well from a service failure, it can create a higher level of trust and loyalty with customers than if no failures had occurred (Magnini et al. 2007). Of course, this finding has many implications, if the motivation in optimizing provider value is seen as customer manipulation. Loyalty programs that provide enhanced benefits to customers, even when a failure has not occurred, can have a similar impact. Customer lifetime value-informed investment strategies also create enhanced outcomes that pay off over the lifetime of interactions and outcomes (Rust et al. 2000).

SS-FC5: Value Propositions

Value propositions are offers to play nonzero-sum games and are at the heart of competing for collaborators. Often the value to the provider of the offer is hidden and not accessible to the intended customer. In some cases the provider outcome is not hidden. For example, in so-called ultimatum games, a player may refuse benefits, if a culturally determined sense of fairness in allocation is not realized (Spohrer, Anderson, Pass, Agre 2009; Wright 2000). In the cases where provided benefit is unknown, the customer will evaluate the value proposition relative to similar offers from the provider's competitors. If no similar offers exist to choose from, then the offer can be viewed as competing at a higher level for the attention, time, and other resources of the customer.

The science of value proposition design is evolving rapidly (Spohrer, Anderson, Pass, Agre 2009; Wright 2000). The essential considerations include models of other stakeholders' capabilities, limitations, and processes of valuing. A customer must understand an offer, agree to the offer, and then contribute (cocreate, coproduce) to realize the benefits of the offer. The more sophisticated the offer, the greater the customer's capabilities must be to understand, agreed to, and realize the outcome. Stakeholders include the provider, customer, competitors, and authority. Competitors may include the customer (self-service), legitimate competitors (abiding by the same laws and constraints), non-legitimate competitors (criminals, black or gray markets), and authority (government or social sector programs) and even online or other competitors who can play by different rules.

Worth (SS-FSC11) *and value* (SS-FSC12) are different concepts (Ng 2012). Worth is a point-in-time decision about what an entity is willing to pay for some anticipated future value. Value is an experience of goodness that is contextualized by an individual. Individuals will evaluate if an offer (value proposition) is worth it and if an offer (value proposition) became realized as anticipated or provides superior value.

Risk (SS-FSC13) *and reward* (SS-FSC14) are unknowable in advance and so must be estimated (Adams 2000). Every offer (value proposition) has associated risks and rewards that may be hard to anticipate and estimate. Some entities have greater risk tolerance than other entities.

Processes of valuing (SS-FSC15) *and deciding* (SS-FSC16) are ultimately at the heart of service science. If we had a perfect model of our own processes of valuing

and that of all other service system entities, and we had perfect data about the world and unlimited computational capabilities, then the science of service could become more objective. Advances in cognitive science and the brain sciences do in fact help researchers build betters models of processes of valuing and deciding, and increasing computational capabilities can help certain well-scoped systems operate more optimally. Processes of valuing generate options and rank them. IBM's Watson supercomputer, known for its prowess in outscoring the top human Jeopardy! winners and creating diagnostic options for doctors to consider, is an example of a system with algorithmic processes of valuing (Ferrucci et al. 2010). Processes of deciding are tied to action. A decision with no action is not a true decision. Risk tolerance often prevents individuals from taking action even when processes of valuing suggest great potential rewards for certain options. It may be worth it to have others take the actions, but principal-agent problems may then arise, creating a different type of risk. Perhaps the order of magnitude observation (see above SS-FC1) combined with better governance mechanisms (SS-FC6) may offer a solution to many types of principal-agent problems, thus advancing the practice of value proposition design.

SS-FC6: Governance Mechanisms

Governance mechanisms are based on a system of rules or laws that constrain entity interactions, with coercive power. Formal service system entities (SS-FSC1) exist as formal entities because of their rights and the power of an authority service system entity to recognize, protect, and uphold those rights. Smart machines do not yet have rights. Businesses do have rights because of laws. Both laws and technologies contribute to the knowledge burden of society. A nation without coercive powers would have to exist based purely on voluntary value propositions and no such nation exists. The weakest form of coercive power is banishment, or cessation of existence *here*. The strongest form of coercive power is death of individual, family, and species with permanent erasure of historical mentions or cessation of existence *everywhere for all time*.

Only one set of service system entities legitimately retains rights to coercive value propositions that can threaten the fundamental rights including the right of refusal and right to exist, and that is government authorities. Criminal service system entities also use coercion, but they operate outside of national and international laws. All other service system entities are restricted to voluntary value propositions and use coercive value proposition only in criminal or private/nonpublic situations.

Rights (SS-FSC17) *and responsibilities* (SS-FSC18) go hand in hand. Rights are a privilege earned through responsible actions. Unless a service system has the capability to understand the responsibilities that accompany rights, they cannot enjoy those rights. Young children, debilitated elderly, and other individuals' cognitive or mental impairments may have restricted rights, because of their limited cognitive capacities.

SS-FC7: Resources

Resources can exist in four types: people; technology; organizations; and information. People and organizations are operant resources (actors), and technology and

information are operand resources (used by actors). People augment themselves with technology and organizations to increase their capabilities and overcome constraints. This augmentation can positively impact quality of life, but can also introduce a significant knowledge burden on society. The size of the knowledge burden is reflected in the quantity of shared information. Shared information includes language, laws, measures, and much more.

Resources exist in context, as either as physical or not physical, and with rights or without rights. In the context known as the real world, people are an example of a physical resource with rights and businesses are an example of a nonphysical resource with rights. Even though a business may have buildings, or component physical resources, no physical component is essential to a business, and a business can stay in existence with none of the original buildings or people that were originally part of it. However, the body of a person is an essential part of that person, and so a person is a physical, with-rights resource, even though a person as a service system entity includes far more than just the body of the individual person. A person as a service system entity is a much larger resource constellation or configuration of component resources. For example, my car and house are component resources with the service system entity, which makes me up as an individual.

SS-FC8: Access Rights
Access rights include owned outright, leased or contracted, shared access, and privileged access. Owning property versus leasing property comes with different rights and responsibilities. Similarly, shared access resources, such as roads and the air we breathe, come with different rights and responsibilities, compared to privileged access resources, such as one's own thoughts or family members.

SS-FC9: Stakeholder Roles
Stakeholder roles include customer, provider, authority, and competitor. An employee may be viewed as all of a provider to a business, a customer of the business' benefits program, an authority governing and resolving disputes associated with certain business processes, and a competitor of another employee interested in the same organizational role. Service system entities are at once customer, provider, competitor, and authority, depending on the perspective. When considering social value, it is also useful to consider the community surrounding the service system as a stakeholder (Tracy 2011; Tracy and Lyons 2013).

SS-FC10: Measures
Measures include quality, productivity, compliance, and innovativeness. Many other measures and key performance indicators can be associated with service system entities or processes in which an entity participates. Measures allow ranking of service system entities. For example, universities (as service system entities) may be ranked based on the starting salaries of their graduates. Holistic service system entities may be ranked based on innovativeness, equity (competitive parity), sustainability, and resilience. Social organizations can be measured by resulting social value to participating entities and the broader service ecology.

3.4 Service Science Foundational Premises (SS-FP)

Maglio and Spohrer (2013) have been evolving foundational premises for service science. Others linking the concept of viable systems to service systems are also working on foundational premises (Barile and Polese 2010; Boulding 1956). An extension and evolution under consideration is presented below:

SS-FP1: All Viable Service System Entities Dynamically Configure Four Types of Resources: People, Technologies, Organizations, and Information
Put another way, a service system that cannot dynamically configure resources is not viable. The application of knowledge to dynamically configure access to resources for mutual benefits is a fundamental capability of service system entities, and often access to resources (rights and responsibilities) must be earned. For example, earning a driver's license is an earned right that requires demonstrating capabilities and taking on additional responsibilities. Earning and using a driver's license in society requires access to people (e.g., driving test certifier), technology (e.g., a car), organizations (e.g., Department of Motor Vehicles), and information (e.g., rules of the road booklet and test). For example, setting up a business is an earned right that requires capabilities and taking on additional responsibilities—people (e.g., hiring employees), technology (e.g., equipment or environmental resources used in the business), organizations (e.g., working with suppliers), and information (e.g., submitting tax forms on time).

SS-FP2: All Viable Service System Entities Compute Value Given the Concerns of Multiple Stakeholders, Including Customer, Provider, Authority, and Competitor
Put another way, a service system that cannot compute value given the concerns of multiple stakeholders is not viable. For example, a business must offer something of value to customers, maintain relationships with supply chain organizations (providers), obey any regulations that apply to the business (authority), and in the long run outperform competitors.

SS-FP3: All Viable Service System Entities Reconfigure Access Rights Associated with Resources by Mutually Agreed-to Value Propositions or Governance Mechanisms
SDL-FP9 states that all social and economic actors are resource integrators. All economic and social actors apply knowledge to integrate resources. Resources can be divided into three categories: market-facing resources (available for purchase to own outright or for lease/contract), private non-market-facing resources (privileged access), and public non-market-facing resources (shared access). Access rights fall into four categories: own-outright, lease/contract, privileged access, and shared access. Ensuring that nested entities have protected rights and comply with responsibilities is work performed by a governing authority.

SS-FP4: All Viable Service System Entities Compute and Coordinate Actions with Others Through Symbolic Processes of Valuing and Symbolic Processes of Communicating
Written laws and contracts are a relatively new innovation in human history. Computers, spreadsheets, expert decision support systems, and electronic trading systems are even newer innovations. The transition from purely informal promises (moral codes) to formal contracts (legal codes) speaks to the evolution of service systems from primarily informal to increasingly formal. Viewed from the perspective of computer science, artificial intelligence, and organization theory, people and organizations can be modeled as a type of physical symbol system (Newell and Simon 1976; March and Simon 1958). Technological and organizational augmentation layers contribute to the nested, networked nature of the service system ecology (Arthur 2009).

SS-FP5: All Viable Service System Entities Interact to Create Ten Types of Outcomes, Spanning Value Co-creation and Value Co-destruction
ISPAR (SS-FSC9) is an elaboration of the simple four-outcome model (win–win, lose–win, win–lose, or lose–lose) to ten outcomes (Maglio et al. 2009). As articulated in SS-FSC9, ISPAR includes both service and non-service interactions each resulting in one of several outcomes.

SS-FP6: All Viable Service System Entities Learn
If service systems can only apply knowledge in fixed patterns, they will not be able to compete with service systems that learn, adapt, and change to become more competitive. According to the Abstract-Entity-Interaction-Outcome-Universals (AEIOU) theory, service system entities perform four primitive economic activities (production, distribution, consumption, recycling) jointly or separately in time and space (Spohrer and Demirkan 2013). Service systems are complex adaptive systems made up of people, and people are complex and adaptive themselves. Service system entity interactions often exhibit learning curves, or efficiency improvements based on number of interactions (Spohrer, Maglio, Bailey, Gruhl 2007).

3.5 Proposed Research Agenda for a Science of Service

The service research community has taken some steps to define a research agenda and establish research priorities to advance the science of service (Ostrom et al. 2010). The ten priorities include strategic, development, and execution priorities from a managerial (marketing and operations) perspective and one pervasive priority from an engineering (computing) perspective; each priority is described briefly below:

SS-RP1: Strategic Priority: Fostering Service Infusion and Growth
This research priority deals with the ability of organizations to create and improve service offerings to grow. Changing culture (customer focus, service logic,

servitization), strategy, business models (outcome-based), and portfolio management are important research topics related to this priority.

SS-RP2: Strategic Priority: Improving Well-Being Through Transformative Service
This research priority deals with the ability of governments and social enterprises to create and improve service offerings to improve quality of life for citizens and the disenfranchised. Social welfare (health, education), environment (sustainability, green), democratization (open data, transparency), urbanization (smarter systems), and bottom-of-pyramid issues are important research topics related to this priority.

SS-RP3: Strategic Priority: Creating and Maintaining a Service Culture
This research priority deals with ability of organizations to create and maintain a service culture. Human resources (hiring, training, and incentives), globalization (diversity), mind-set (values), and learning (adaptation) are important research topics related to this priority.

SS-RP4: Development Priority: Stimulating Service Innovation
This broad research priority deals with the ability of organizations to innovate to compete. Drivers (globalization, automation), types (incremental, radical), roles and sources (employees, customers, supplier, research, managers, universities), methods (design, arts, creativity), tools (modeling, simulation), and policy (investment, measurement) are important research topics related to this priority.

SS-RP5: Development Priority: Enhancing Service Design
This research priority deals with the ability of organizations to design better customer experiences and outcomes. Thinking (design, systems, processes), arts (performance, visual), challenges (economic cycles, cultural variations, market segments), and methods (collaborative, crowdsourcing) are important research topics related to this priority.

SS-RP6: Development Priority: Optimizing Service Networks and Value Chains
This research priority deals with the ability of networks of organizations to optimize collective performance. Supply chain, outsourcing, value migration, interorganizational governance, globalization, productivity, and optimization algorithms are important research topics related to this priority.

SS-RA7: Execution Priority: Effective Branding and Selling of Services
This research priority deals with the ability of organizations to establish brands to enhance sales. Social media, word of mouth, multichannel, consistency, assessment of brand value, sales force, and employee training are important research topics related to this priority.

SS-RA8: Execution Priority: Enhancing Service Experience Through Co-creation
This research priority deals with the ability of organizations to fully utilize co-creation. Sharing (responsibilities, work effort, risks, rewards, information, and

property rights), role of actors (employee, customer, and manager), role of technology (channels, complexity), customer community management, recovery, and loyalty are important research topics related to this priority

SS-RA9: Execution Priority: Measuring and Optimizing Value of Service
This research priority deals with the ability of organizations to measure and optimize processes. Self-service technologies, return on investment, instrumentation, estimation, standards, portfolio management, and optimization algorithms are important research topics related to this priority.

SS-RA10: Pervasive Force: Leveraging Technology to Advance Service
This research priority deals with the ability of organizations to keep up with and incorporate disruptive technologies into service operations and to use advanced technologies to improve service offerings and customer experience. Platforms (smart phones, cloud computing, smart systems, web services, service-oriented architectures), accelerating change (business models, acquisitions), self-service technologies, real-time decision-making (cognitive computing, stream computing), security, privacy, and biometrics are important topics related to this priority.

Translating these priorities into a set of grand challenge research questions for service science remains to be done, though there have been some tentative efforts in this direction (Tang 2012).

3.6 Proposed Extensions to the Research Agenda

The ten research priorities in the previous section can be seen as priorities aimed at impacting practice with largely managerial and engineering implications. We propose three other priorities aimed at education, policy (tooling), and theory.

SS-RA11: Extension Education Priority: Curriculum
Creating curriculum and best practices for teaching and learning service science is an additional research priority. A curriculum that is designed to create T-shaped service innovators with depth and breadth, who have interactional expertise across disciplines, sectors, and cultures, is being requested by leading employers, to improve innovativeness, teamwork, and learning rates (IBM 2011).

Since service science is a transdiscipline and borrows from so many other disciplines, one interesting proposal for service science curriculum is optimizing the recapitulation of history from a technological and governance perspective (Spohrer 2012). Rapidly rebuilding societal infrastructure and institutions, without the many twists and turns of history, might allow for a compressed, integrated, holistic curriculum. This is also possibly an approach to reducing the knowledge burden, without reducing quality-of-life measures. Ultimately, service innovations, because they depend increasingly on symbolic knowledge and symbolic processes of valuing, must address the rising knowledge burden and the intergenerational transfer of knowledge challenges.

SS-RA12: Extension Policy Priority: Global Simulation and Design Tool
Creating a global simulation and design tool for evaluating alternative governance mechanisms is an additional research priority. Modeling the nested, networked service ecology could also have a profound impact on teaching and learning service science, especially if appropriate pedagogical idealizations can be developed (Spohrer and Giuiusa 2012).

Based on the order of magnitude observation, there is a much larger market for individuals than cities, a larger market for cities than nations. The global simulation and design tool could be used to experiment with policies intended to improve competitive parity between regions at all order of magnitude scales, while increasing the speed innovations could spread globally.

SS-RA13: Extension Theory Priority: Foundations
To put service science on a more fundamental theoretical foundation, it might be a useful research priority to consider a nested, network service ecology based on something other than the human species. For example, a service ecology based on intelligent machines, with greatly extended life spans, much faster learning rates, and much larger and denser populations, might be useful for thinking about a service ecology in the limiting case, when constraints on the basic building block service system entity (individuals) are removed. Alternatively, a service ecology with a diversity of species with different physical, cognitive, and social constraints could open up new theoretical directions for service science. Some work on an AEIOU (Abstract-Entity-Interaction-Outcome-Universals) framework has begun and greatly elaborated this could be part of an expanded theoretical foundation for service science and other transdisciplines (Spohrer and Demirkan 2013).

Understanding and characterizing the fundamental constraints on a species is an important area of research for developing the theoretical foundations for service science. For example, humans have the following constraints:

1. Physical: finite life span
2. Cognitive: finite learning rate
3. Social: finite population size/density

In the last 200 years, life spans have extended, education levels have risen, and population size/density has increased. In complex service systems, as fundamental (weakest link) constraints are removed, other constraints emerge to dominate system performance (Ricketts 2012). The mapping of fundamental constraints for other types of service system entities has not been developed yet.

4 Contribution: Bridging Framework

In many ways a service science perspective on social value is loosely consistent with Mulgan (2010), specifically: convening stakeholders (trading zone), providing a holistic view onto quantitative and qualitative points of view (transdiscipline),

making judgments and prioritizing issues (understanding different values and processes of valuing), giving voice to the weakest in society (the disenfranchised as stakeholders), and continuously listening and acting to manage complexity (knowledge burden awareness, T-shaped individuals).

From a service science perspective, the beneficiary uniquely determines value, and so the differences and similarities of the processes of valuing used by both individual and collective service system entities become of great research interest. What are the characteristics of the processes of valuing, used by a collective service system entity, such as a nation? For example, a collective entity may have a process of valuing that considers any of the following a benefit:

1. Improved interactions with other entities (e.g., win–win mechanisms)
2. Improved rankings relative to other entities (e.g., competing for collaborators)
3. Improved capabilities of sub-entities (e.g., voice for disenfranchised)
4. Reduced knowledge burden (e.g., simpler, greener energy sources or materials)

From a service science perspective, in the case of the above process of valuing, the benefits (social value) of leadership derive from improved governance mechanism interactions, the benefits (social value) of literacy derive from greater capabilities of sub-entities, and the benefits (social value) of money derive from improved value proposition-based interactions.

Tracy and Lyons (2013) found that value co-creation in the context of social enterprises goes beyond assessments of quality and price. In social enterprises, the beneficiary can be the customer as well as society or the community. Even customer perceptions of value go beyond quality and price to include assessments of social, emotional, and functional value. Tracy and Lyons (2013) report that social enterprises (not unlike social organizations such as nations) make use of complex hybrid value propositions which have both intrinsic and extrinsic notions of value.

Thus, from a service science perspective, defining social value becomes reformulated to the empirical task of making explicit the processes of valuing used by different types of collective service system entities.

Considering the SS-FCs in Sect. 3.3, we can depict the service ecology (SS-FC1), entities (SS-FC2), interactions (SS-FC3), outcomes (SS-FC4), value propositions (SS-FC5), and stakeholder roles (SS-FC9) in Fig. 1.1. Within a service ecology, when two entities (each with their own stakeholders) interact through a value proposition, outcomes are achieved for each of the entities.

In Fig. 1.2, we show how making the notion of social value explicit changes the relationships among the service science foundational concepts. First, the community stakeholder is made explicit. Second, in addition to value propositions associated with the interaction between two entities, there are value propositions with the broader ecology and community stakeholders. Finally, there can be outcomes to the community resulting from the interactions between two entities.

In spite of the synergies between social value and the service science foundational concepts and SD logic foundational premises, one of the ultimate challenges in defining social value from a service science perspective arises from SDL-FP10. If the beneficiary is not an individual, but all stakeholders, all the citizens of a

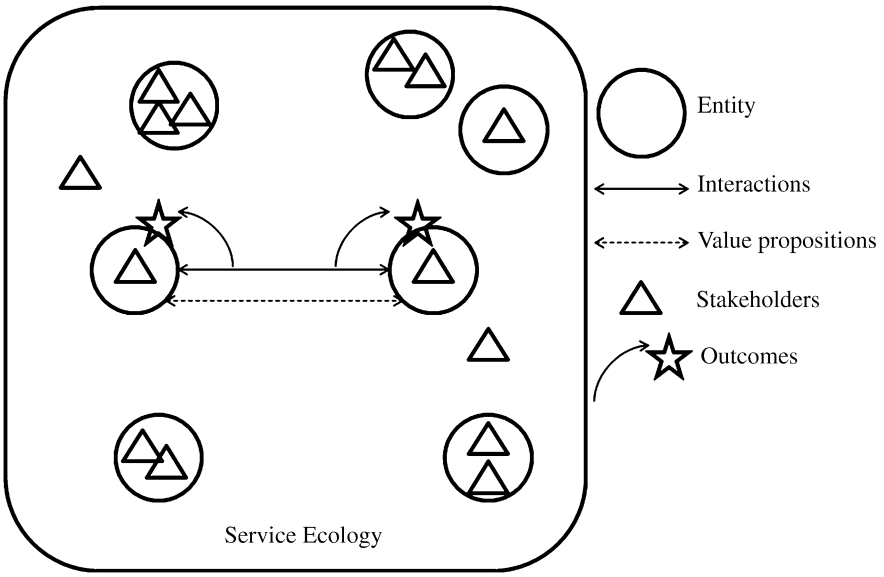

Fig. 1.1 Depicting service science foundational concepts

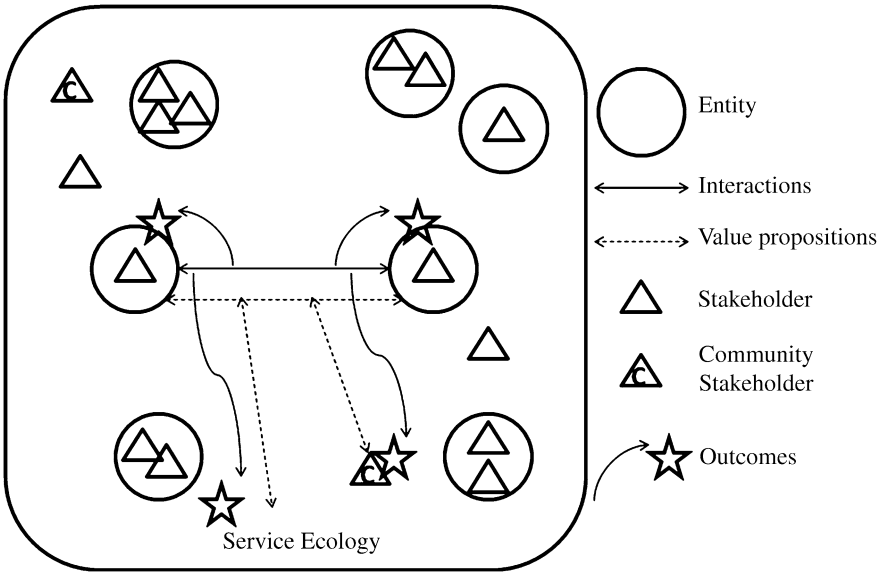

Fig. 1.2 Making social value explicit in service science concepts

nation, does that include criminals and revolutionaries seeking independence or other groups who are working outside the authority and governance mechanisms? The formal legal nature of service science becomes evident when asking these questions. Since formal service system entities seek to make explicit (e.g., symbolic and objectively operational) their processes of valuing, it is possible to estimate the social value from the perspective of any such formal service system entity. Can those entities revise their processes of valuing? Yes. Can those entities possess multiple competing processes of valuing? Yes. Can some processes of valuing be more easily operationalized than others? Yes. So in the end, what we are left with are multiple individual stakeholders with competing processes of valuing, which may be quite inconsistent and incomplete. In fact, some individuals who are part of the formal service system may not care enough or have enough capability to even have an opinion. Such is the complex nature of nonindividual formal service systems. Mechanisms for combining many individual perspectives exist, for example, electing a leader and adopting that individual's process of valuing as a surrogate for that of the electorate. Other mechanisms might include mechanisms for individuals to vote with their wallets, their time, or other resources, to provide those who care most about the issue to have a larger say in what is finally adopted and put into use. However, what about the weak, or disenfranchised, how does crowd funding (governance mechanism innovation) help them, when they have no financial resources?

The life span of any service system entity can be seen in terms of interactions and outcomes, but underlying those interactions are many instances of processes of valuing and decisions on how to act. Processes of valuing impact not only how we evaluate value propositions, but how we negotiate/agree and then work to realize the outcomes agreed to. How can we bridge individual processes of valuing with social entity processes of valuing? Both are often distributed cognition (Hutchins 1995), in the sense that even an individual's processes of valuing may include reaching out to ask the opinion of others or going online to research some alternatives. Processes of valuing are distributed in our cognition, and studies of decision-making when people are sleepy, hungry, emotional, or inebriated show cognitive effects, including delayed reaction times. When and what we eat and drink, when we sleep, when we get out of bed, what we do, how we react to things, all these and more are part of individual processes of valuing. What we decide is a separate process, but our individual processes of valuing create a list of candidates and rank orders them, even if it is only as simple as "Do It" or "Don't Do It." Unless our processes of deciding are based on something unusual, we probably select the top ranked choice from our processes of valuing. In social environments, one must weigh many aspects from multiple perspectives when making decisions. Rank orders have to take into account multiple perceptions of value.

Finally, over time service scientists working to understand and innovate social value must develop and apply relevant frameworks, theories, and models of social value. Ostrom (2009) proposed a specific relationship between frameworks, theories, and models that we adopt and extend. A framework provides shared language to describe real-world phenomena in terms of concepts and qualitative relationships that sharpen shared observations about what exists and how it came to exist (ontology). A theory provides rigor both in terms of measurement methods and

empirically testable propositions to expand what is known and how it comes to be known and more efficient ways to arrive at and accumulate knowledge (epistemology). A modern model provides boundary conditions on a theory as well as a computational implementation that can be used to design, engineer, and manage new instantiated systems and realize benefits of theory-based knowledge constructs through appropriate real-world actions (praxeology). For example, the literature on social value from economic theories of social value has considered private value versus the social value of information, which potentially has practical consequences in the design of patent systems (Hirshleifer 1971). Also, we need to keep in mind that at the end of the day, we are debating about experiments to perform on ourselves. Nations and societies are like petri dishes.

5 Concluding Remarks: Future Directions

We live in a human-made ecology of nested, networked service system entities—people, families, businesses, universities, cities, states, nations, and more. Humans are unique in our ability to communicate, collaborate, compete, and realize shared dreams about the future, from start-up grand challenges (like building a social graph of the world) to national grand challenges (like landing a man on the moon), to scientific grand challenges (like mapping human DNA). Humans have evolved to compete for the cooperation of larger and larger groups of others. Many competitions are in fact mechanisms for cooperation in disguise, positively reinforcing rule-following compliance and punishing rule violations. Balancing competition and cooperation to accelerate learning and social benefits is fundamental.

The human ecology of nested, networked service system entities has already evolved through several technical infrastructure stages, remarkable in terms of energy, transportation, and communications, which enable great cities to emerge at an accelerating pace (Hawley 1986). Designing alternative viable futures for people in an age of rapidly increasing technical and organizational capabilities presents many challenges and opportunities. For example, policymakers understand that norms and laws must coevolve with technical capabilities created by engineers. Two important types of constraints shaping the evolution of service systems are the technical and environmental capabilities (infrastructure) and governance responsibilities (institutions). These two constraints interact with two other constraints, the education and skill levels (individuals) and quality-of-life aspirations of families (cultural information). Service is the application of knowledge for mutual benefits (value co-creation). Service innovations scale the benefits of new knowledge globally and rapidly. T-shaped professionals are professionals with depth and breadth of knowledge across academic disciplines, industry sectors, and regional cultures. T-shapes balance depth and breadth to optimize abilities to compete as individuals and collaborate in teams. Appropriate breadth has the potential to improve innovativeness, teamwork, and learning rates.

In this chapter, within the context of providing a service science perspective on social value, we presented a preliminary bridging framework for analyzing the

historical evolution of service system entities to date and exploring the design space for alternative viable futures. Surprisingly, we argue that dealing with the knowledge burden of society, which helps people develop the skills to rapidly rebuild societal infrastructure and institutions along alternative possible historical pathways, may open up the largest design space for alternative viable futures. This chapter has implication for those in academics, industry, government, and the social sector interested in a more service-oriented view that balances past, present, and future possibilities.

A good ending point for an exploration of the concept of social value from a service science perspective is the quote from George Box saying that, "Essentially, all models are wrong, some are useful" (Box 1979, page 202). We believe that creating a trading zone for the development of service science as a transdiscipline, which borrows from disciplines without replacing them, is a useful and timely model. However, much work remains on multiple fronts to create more T-shaped service innovators, including advancing the practice, education, tooling/policy, and theoretical foundations for a science of service.

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6 Appendix: Concepts Discipline, Researcher, etc.

Researchers from many disciplines have contributed to advancing service science and the study of service systems. Based on a sampling of publications (Spohrer 2013—http://service-science.info/archives/2708), some disciplinary branches are partially summarized in the table below.

Concept	Discipline	Researcher	Journal	Conference	Association
Stakeholder customer	Marketing	Rust	JSR, CACM	Frontiers	AMA, INFORMS, ASA
		Fisk	JSR	Frontiers, AMA SERVSIG	AMA
		Bitner	JSR, CACM	Frontiers	AMA
		Vargo	JM, JAMS	Frontiers	AMA
		Lusch	JM, JAMS	Frontiers	AMA
		Gronroos	JSR, JAMS	Frontiers, QUIS	FSSL
		Edvardsson	JAMS	Frontiers, QUIS	
		Gummesson	JBIM	Forum, QUIS	SSEBA, ISQA

(continued)

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Concept	Discipline	Researcher	Journal	Conference	Association
Stakeholder provider	Production operations	Sampson	JSR	POMS	POMS
	Operations management	Neely	OMR	Alliance	EOMA
		Davis	IBMSysJ, OMR	ArtSci	DSI, POMS
		Metters	DS	POMS	DSI, INFORMS, POMS
		Apte	POMS	POMS	POMS, DSI
	Operations research	Larson	JoSS		INFORMS
		Badinelli	JoSS	Forum	INFORMS,ISSIP
Stakeholder authority	Governance	Piciocchi	JoSS	Forum	ISSIP
		Bassano	JoSS	Forum	ISSIP
Stakeholder competitor	Strategy	Polese	JoSS	Forum	ASVSA
		Barile	JoSS	Forum	ASVSA
Resource people	Social sciences anthropology	Baba	CACM	HSSE	AAA NAPA
	Cognitive science	Glushko	JSR, IBMSysJ	Frontiers, HSSE	CSS, OASIS
	Human factors	Freund	HFEMSI	HSSE	HF&E, IIE, ISSIP
Resource technology	Industrial engineering	Rouse	IBMSysJ		IIE, INCOSE
	System engineering	Tien	JSSE		IEEE, NAE
		Berg	JSSE		IEEE, NAE
Resource information	Computer science	Spohrer	CACM, JAMS, Computer	Frontiers, HSSE, AMCIS	ACM, ISSIP
		Maglio	CACM, JAMS, Computer	HICSS	ACM
	Information systems	Alter	IBMSysJ	AMCIS	AIS, IFIP
		Demirkan	CACM, ECRA, JMIS, JSR	AMCIS, HICSS	AIS, ISSIP
		Kwan	IJISSS	AMCIS	AIS, ANSI, ISSIP
	Information management	Karmarkar	MS	BIT	INFORMS
Resource organizations	Economic geography	Bryson	SIJ		
	Service systems	Ng	EMJ	Alliance	
	Social enterprises	Lyons	HFEMSI	HSSE	AIS, ISSIP

Journals: *CACM* Communications of the ACM, *Computer* IEEE Computer, *ECRA* Electronic Commerce Research and Applications, *EMJ* European Management Journal, *HFEMSI* Human Factors and Ergonomics in Manufacturing & Service Industries, *IBMSysJ* IBM Systems Journal, *IJIMA* International Journal of Internet Marketing and Advertising, *IJSIM* International Journal of Service Industry Management, *IJISSS* International Journal of Information Systems in the Service Sector, *ISEBM* Information Systems and E-Business Management, *MS* Management Science, *JAMS* Journal of the Academy of Marketing Sciences, *JBIM* Journal of Business & Industrial Marketing, *JOSM* Journal of Service Management, *JSR* Journal of Service Science, *JSSE* Journal of Systems Science and Systems Engineering, *MSQ* Managing Service Quality, *OMJ* Operations Management Research, *SIJ* The Service Industries Journal
Conferences: *Alliance* Cambridge Alliance Conference, *AHFE* Applied Human Factors and Ergonomics Conference, *AMA SERVIG* AMA SERVIG Conference, *AMCIS* Americas Conference on Information Systems, *ArtSci* Art & Science of Service Conference, *Frontiers* Frontiers in Service Conference, *HICSS* Hawaii International Conference for Systems Sciences, *HSSE* AHFE Human-Side of Service Engineering, *Forum* Naples Service Forum, *POMS* Production and Operations Management Society, *QUIS* Quality in Services
Associations: *AAA* American Anthropological Association, *AAAS* American Association for the Advancement of Science, *ACM* Association for Computing Machinery, *AIS* Association of Information Systems, *AMA* American Marketing Association, *ANSI* American National Standards Institute, *ASA* American Statistical Association, *ASVSA* Associazione per la ricerca sui Sistemi Vitali (Viable Systems), *CSS* Cognitive Science Society, *DSI* Decision Science Institute, *EOMA* European Operations Management Association, *FSSL* Finnish Society of Sciences and Letters, *IEE* Institute of Industrial Engineers, *IEEE* Institute of Electrical and Electronic Engineers, *IEEE EMS* IEEE Engineering Management Society, *INFORMS* Institute for Operations Research and the Management Sciences, *ISQA* International Service Quality Association, *ISSIP* International Society of Service Innovation Professionals, *NAE* US National Academy of Engineering, *NAPA* AAA National Association for the Practice of Anthropology, *NYAS* New York Academy of Sciences, *OASIS* Advancing Open Standards for the Information Society, *SSEBA* Swedish School of Economics and Business Administration

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