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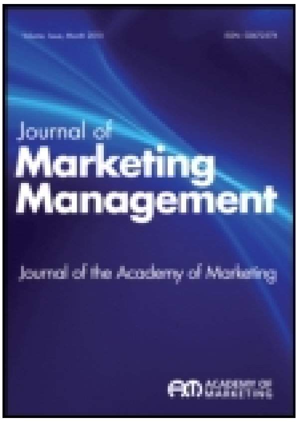

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Evolving service for a complex, resilient, and sustainable world

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Evolving service for a complex, resilient, and sustainable world

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Abstract As the world evolves complex interdependencies, it is more important than ever to pay special attention to service system resiliency and sustainability. The emergence and growth of service science and Service-Dominant (S-D) Logic helps to encourage systems-level thinking and provides at least some initial guidance on developing appropriate 'mind-sets' and skills. In turn, this provides the means to be more innovative in developing solutions to 'wicked' human problems that growing complexity brings forth. Undoubtedly, some of these innovative solutions must deal with policymaking. And some of these policies may encourage new types of value-propositions that grant shared access rights to resources while developing new rules that allow the co-evolution of dispute resolutions. This invited commentary on service integration and coordination in a complex world should be of value to enterprises and governments searching for ways to adopt a more service-oriented perspective and develop more innovative service offerings.

Keywords service science; Service-Dominant Logic; systems thinking; complexity; innovation

Introduction

It seems axiomatic that each new generation reflect that, in earlier years, things were simpler. In part, the reflection is on products that were relatively less complex and on a time when there was less information overload. In addition, there is also a sense that relationships were simpler and face-to-face interactions more common. As we mature and start playing roles in societal institutions that stretch beyond local family and community, we increasingly interact directly and indirectly with people previously unknown to us (Gutek, 1995; Seabright, 2005). We become, to a degree, connected to an ecosystem of other actors, institutions, languages, and technologies, and consequently we may feel at once competently mature and at the same time more 'complexified'. Furthermore, in many situations, this feeling of being entrapped by complexity maps well onto the reality of how interconnected (to friends and strangers) and augmented (by technologies and institutions) we have become.

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Probably billions of people are feeling the same way too. The available evidence suggests that the complexity of the world and, associated with it, increased turbulence and often-chaotic behaviour is accelerating (Wood, 2009). In brief, we better get used to societal change and make peace with it.

It is probably not surprising that, as we look back over the last decade, service science and Service-Dominant (S-D) Logic emerged almost simultaneously. Service science arose in response to global trends as nations and businesses witnessed increased demand for knowledge-intensive service innovations. For example, IBM's own transformation to a service-led globally integrated enterprise has had a mission to build a smarter planet, employing a growing number vertically and horizontally orientated, or T-shaped service scientists, including computer scientists, engineers, managers, and mathematicians (Donofrio, Sanchez, & Spohrer, 2009; IBM, 2011; Palmisano, 2006, 2008). Similarly, S-D logic, which has been described as foundational to service science (Lusch, Vargo, & Wessels, 2008; Maglio & Spohrer, 2008; Vargo & Akaka, 2009; Vargo, Lusch, & Akaka, 2010), is a new logic that emphasises the integrated and holistic nature of business interactions. S-D logic focuses on the exchange of knowledge and the application of human skills and capabilities or service-for-service exchange. This exchange of service-for-service moves from direct to indirect interactions where goods are seen as only one of the many ways through which value is negotiated.

Over the last decade, we have witnessed service science and S-D logic thinking permeate society (slowly but surely) and the way enterprises, nations, and individuals start to think about innovation in a highly interconnected and complex world (Lusch 2011). Our goal is to begin to outline how we can start to make sense of complex worlds, and harness individual and collective capabilities and skills for co-created innovation that results in a more sustainable and resilient world.

Making sense of complex worlds

Making sense of complex worlds is facilitated by developing a mind-set around which to view the world. Norman (2011) in his book *Understanding Complexity* makes a distinction between complexity and complicated. For Norman, complexity 'describes the state of the world' and complicated 'describes a state of mind' (p. 3). Complexity is thus inherent in the thing or the system: a 2011 Ford Fusion is more complex than a 1903 Model T Ford; the city of Rome is more complex than a hunting camp of 10,000 years ago.

Because it is a state of the world, complexity can be thought of in an algorithmic way, such as the number of bits required for replicating the connections between the parts of the system. Complexity can be intersubjectively measured and validated (Weinberg, 2001). On the other hand, 'complicated' is uniquely determined by each actor, based in large part on an actor's particular history and experience. If either of us were to visit Rome, which we both have done on many occasions, we would view it as complicated. However, someone our age who had grown up in Rome and occupied similar roles that we occupy in our professional and family lives would generally view Rome as less complicated.

As actors view the world as more complicated, it is manifest in complexification, or increased cognitive and emotional load. This increased load often results in a positive sense of challenge and a negative sense of anxiety in performing routine tasks.

Thus the human actor often experiences the overall feeling of not understanding or not being able to predict the world easily (Montague, 2006). Regardless of if we are considering complexity or complicated (complexification), service science and S-D logic need to develop an understanding of both. This will allow us to gain an understanding of the systematic ways that individuals and institutions can innovate and evolve value propositions.

Small versus big worlds

When adopting an actor-centric S-D logic and A2A focus (Vargo & Lusch, 2011), it is useful to make the distinction between a small and big world – or what can be thought of as small and big service systems. If you are an individual actor and as you look to actors and other things that you directly connect to, through exchange and other interacting and interfacing, you will tend to see a relatively small service system, which, from your vantage point, is not very complicated. This, of course, would have been even more the situation for most individuals who lived 200 years ago. On the other hand, if you begin to zoom out and consider the actors and things that indirectly connect to you because they are second, third, and further tiers and ties away from you and the other service systems that comprise these tiers and ties, the world around you increases in size and, along with it, both complexity and how complicated it is to you.

Sources of complexity

What are the sources of complexity? The primal source is innovation. Disruptive innovations often make the world less predictable for a time while individuals, institutions, and the whole culture adapts. An innovation is a novel, not easily predicted solution to problems that are often, in part, caused by prior innovations (Barnard, 1938/1968; Seabright, 2005). As we design solutions, we make the world more complicated. Norman (2011) argues that although designers may desire to make tools (goods, appliances) simpler to use, hidden behind the scenes is almost always more complexity.

Brian Arthur (2009) theorises that all innovations are the result of combining prior resources (innovations) into novel recombinations, or what S-D logic refers to as resource integration. Every resource integration effort allows us to do things a bit differently, and hopefully these resource integration efforts lead to solving significant problems, resulting in major innovations, even sometimes Schumpeterian in nature. However, as we integrate more and more resources, there is a concomitant increase in complexity. In fact, the complexity becomes so large that no one can make a pencil (Petroski, 1992; Read, 1958), let alone more substantive things such as an airplane or nuclear reactor.

The path of human evolution is characterised by problem solving and innovation and recognition that specialisation and cooperative exchange can be advantageous (Barnard, 1938/1968; Seabright, 2005). Augmenting human performance (and capabilities) with technology and institutions (Spohrer & Engelbart, 2004) can overcome individual human limits and lead to collaborative solutions. As Norman (2011) points out, we can increase our capabilities by integrating knowledge (transformed selves), tools (other things), and organisations (other people). Importantly, this is consistent with S-D logic, since it views knowledge as one

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of the most fundamental operant resources for gaining advantage, tools as frozen knowledge and service distribution mechanisms (Vargo & Lusch, 2004, 2008), and organisations as assemblages of micro-specialists that combine their competences and skills with other resources to enable the firm to offer more compelling value propositions. However, all of these processes, as they develop over time, form the basis of an ever-expanding complex world and service systems (Lusch, Liu, & Chen, 2010).

Lusch and Vargo (2006) suggest that, as exchange increases in society, it both creates change and provides the catalyst for more frequent change in the world. When the division of labour in the world increases, both the connectedness of individuals and the extent of the market rise (Lusch & Vargo, 2006). Because actors need to interact with others, they need to adapt constantly to each other, and the system not only becomes more complex, but it also needs to become more adaptive.

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Sources of complexification and cognitive load

Human actors become more cognitively loaded as the information avalanche (Gleick, 2011) and complexity of the world increases (Wood, 2010). Humans are not able to understand a complex world for a variety of reasons, but what humans are able to do is develop solutions that allow them to navigate in a complex world. The two meta-solutions to the problem of cognitive load are the outsourcing of memory storage and information processing through the development of institutions and tools. Simply, the ability to use language to encode messages outside the human body (on stone tablets, parchment, or silicon) allows for extrasomatic information to be stored, and the ability to use tools and institution to coordinate behaviour or to encode rules into tools and institutions allows humans to need to process less information for daily thinking. Essentially, we deal with cognitive complexity using innovations in extrasomatic memory and extrasomatic information processing. Humans separate themselves from other species in this regard.

Outsourcing memory storage and information management is efficient and effective (in most situations). Actors do not have to worry much about recalling facts and figures because they can rely on external recording mechanisms and access this information on demand. Being able to embed this information externally makes collaborative exchange more viable, and complexity less daunting (Norman, 1994).

One of the practical realities of the world is that, to the human actor, it appears to be less complex than it is. We have developed coping heuristics (Simon, 1996) for dealing with this complexity. Some of these heuristics are embodied in institutions (Loasby, 1999). Hence, as the world becomes more complex, we innovate around tools and institutions, resulting in experiencing less anxious feelings of complexity. This is because tools and institutions simultaneously mask some aspects of the underlying complexity of the world while opening up new areas of challenge and opportunity.

Innovating around complexity

When innovating in a complex world, the first priority is to understand that no human actor can do it alone. Despite the common attribution of major or radical innovation to sole inventors throughout history, from Da Vinci to Guttenberg to Edison to Curie to Shockley, innovation has always been a collaborative and sociocultural process. Stated alternatively innovation is co-created. Not only are other actors involved but also a host of other resources that were a part of prior innovations, and this includes the myriad of tools and institutions that resulted in extrasomatic memory and information processing, as previously described. Furthermore, we cannot forget the development of institutional phenomena such as property rights, money, and contracts that are a vital part of the co-creation of innovation (Arthur, 2009; Friedman, 2008).

Innovation, since it is always co-created, can be viewed as embedded in an innovation service system. Within this system, the innovator(s) have overlapping but often divergent institutional logic(s). Sharing of institutional logics has the advantage of reducing cognitive distance between the actors (Lusch & Nambisan, 2012). However, this can be a disadvantage because having actors with divergent institutional logics is often a source of innovative ideas. Always fighting against the innovator (institutional entrepreneur) are actors trying to maintain the status quo (institutional maintainers). They want to continue to exploit what the enterprise or society knows best, but this comes at the cost of exploring new territory (Radjou, Prabhu, & Ahuja, 2012). Exploration of new terrain is especially helpful during times of turbulence (Tay & Lusch, 2007). Balancing exploitation versus exploration has long been identified as a key survival strategy (March, 1991) and, increasingly, enterprises seek to be ambidextrous (Tay & Lusch, 2007) by combing exploitation with exploration.

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Strive for modularity

As the world and its service systems become more complex, a modular structure that comprises tangible and intangible components (resources) and which uses protocols to facilitate the interaction of actors and resources (or resource bundles) becomes more appropriate and advantageous (Lusch & Nambisan, 2012).

In a complex world, it is desirable to be more resilient, and this is facilitated by a move to layered modularity (Baldwin & Clark, 2000). Layered modularity (Adomavicius, Bockstedt, Gupta, & Kauffman, 2008), where each layer is associated with a different design hierarchy, moves the enterprise away from a fixed service boundary and towards a service-agnostic capability. This results in a very high generative power for innovation. As the layered modularity expands, the market expands. Modularity, either layered or un-layered, is the contemporary equivalent of standardised and interchangeable parts and the division of labour which drove much of the productivity of the industrial revolution.

Managing in a complex world

Innovative enterprises need to move beyond the mainstream institutional logic of business and marketing management, which is still largely centred on analysis, planning, and control. This logic suggests that firms need to produce and distribute goods and services efficiently, along with setting price and promotion to maximise profits. This framework, if it works at all, does so when the market is simple, unchanging or slowly and systematically changing, and where competitive actions are predictable.

Managing in a complex and dynamic world needs to be more responsive, adaptive, and flexible. It should include sensing, resourcing, realising, and learning. This notion builds on the pioneering work of Haeckel (1999). Enterprises need to be connected to their suppliers, customers, and stakeholders to such an extent that they can sense what their needs are and how to develop innovation solutions bundled into compelling value propositions. An enterprise may become so good at sensing that it knows customer needs before the customer. These enterprises can reach the stage where they are so innovative that they drive markets as opposed to being market driven (Jaworski, Kohli, & Sahay, 2000). To make offerings viable, the enterprise also needs to be very good at resourcing. Resourcing involves resource acquisition, resource creation, and removal of resistances (Lusch & Webster, 2010). Importantly, these resistances are often in the form of institutional logics that fight for the maintenance of doing things the old way (Moore, 2011). Resourcing is essential to implementation, but it is also supplemented by the philosophy of realisation or assisting all relevant actors – suppliers, employees, customers, authorities, even competitors – through mutually beneficial standards. However, it is customers who typically bring revenue to the firm, and thus they must be the primary focus. Finally, control is viewed as a learning opportunity. When actual performance deviates from plan, it is a chance to learn more and understand more about service offerings. Under a goods-dominant logic, the plan is viewed more as a given reality, and when managers produce results below plan, it is often treated as the fault of management or employees. In a dynamic and complex world, this is almost always foolish behaviour. Thus, we argue, the logic must be reversed. Failure to meet plan represents a learning opportunity and not an occasion for punishment.

Co-creating a more sustainable and resilient world

To survive and prosper over the longer term, enterprises must become a vital part of a co-creating, sustainable, and resilient world (Auerswald & van Opstal, 2009). Starting this journey can begin by first adopting the lens of the ecosystems thinker and then the lens of the ecological thinker.

From ecosystem to ecological thinking

All enterprises are part of an ecosystem (Spohrer & Maglio, 2010). The ecosystem of actors, with their rights and responsibilities, includes people, organisations, and societal institutions. In addition, the natural and artificial environment, which is viewed by actors as a backdrop for business, also makes up the ecosystem. The artificial environment includes both physical artefacts and non-physical information and ideas (sometimes called memes). These four types of fundamental resources (those with rights and without rights, physical and non-physical) are part of an intricate network of relationships. This is embedded within multiple types of exchanges that include economic, social, and cultural interactions.

There is a tendency to believe that such amazing intricate and complex ecosystems must have been master planned or designed, but the opposite is the case (Mars, Bronstein, & Lusch, in press). This ecosystem, or more accurately ecology, emerges out of actor-to-actor exchanges and interactions. Some of these are positive for the actors. Some benefit one actor and not the other(s), and, in some cases, all

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interests can be harmed (Bronstein, 2009). These actor-to-actor exchanges and interactions ripple out and affect other actors who themselves are indirectly involved in exchanges and interactions. What emerges is a complex human ecology (Hawley, 1986). Interestingly, the emergent ecological structures are an excellent example of co-creation at work.

We borrow from the recent work on the ecosystems concept (networks of individual actors) from ecology (networks of populations of actors) and how this thinking can be applied to organisations (Mars et al., 2012). In brief, we suggest that service science should pay particular attention to the following characteristics of ecology:

Diversity

How is actor diversity related to higher resiliency? This is a central design question to be researched, because more than just sustainability, resiliency involves rapidly springing back after disruptions and outside shocks (Auerswald & van Opstal, 2009).

Keystone species

Keystone species have a considerable effect on stability. The study of keystone enterprises and 'essential institutions' should also be encouraged (Iansiti & Levien, 2004).

Specialists and generalists

Actors can be more or less specialised or generalised. A recurring question in both organisations and the ecology, of which they are part, is the mix of generalist and specialists, and especially what is needed in the management and senior executive suite. However, the question also goes to the enterprise itself: should it be a generalist or specialist niche actor (Spohrer, Gaeteno, Piciocchi, & Bassano, 2010)?

Nestedness

'Nestedness' occurs when networks are embedded within larger networks. For example, universities are nested in cities, which are nested in states, which are nested in nations. The higher the order of nestedness, the more resilient the system becomes. Importantly, in a nested network, collapse from the removal of key actors is slower. Therefore, an important design question relates to the consideration of nestedness, and the redundancy of networks, to enable more resilience.

Fitness

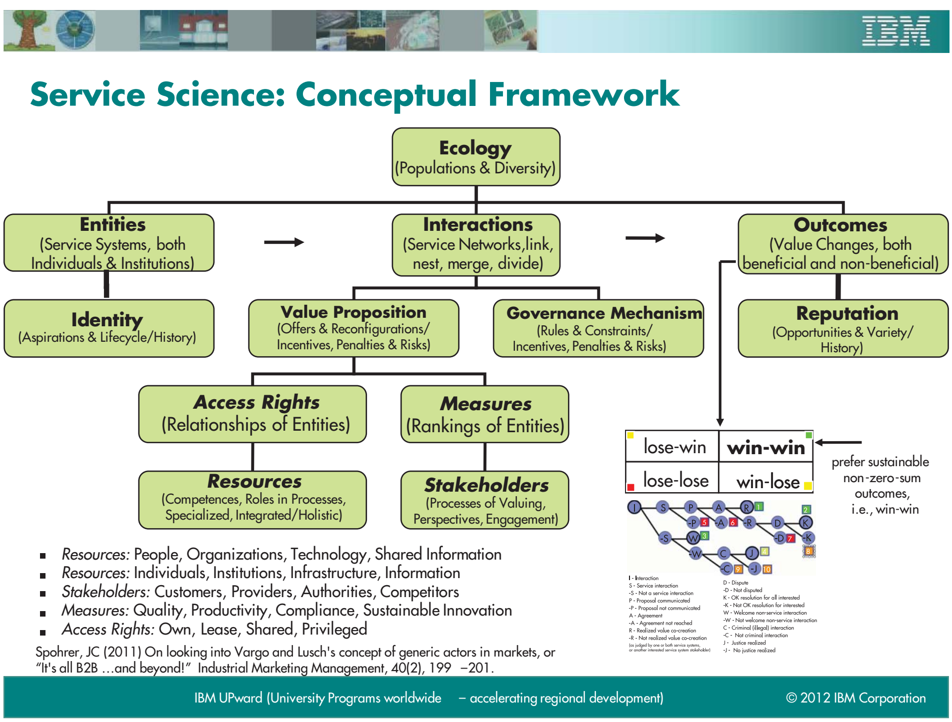
'Fitness' is more than mere existence, persistence, or even agile adaptation. If we look at the history of ecologies, organisations, or societies, the time from what appeared to be a fit (healthy) system to collapse is relatively short. This has key implications for service science. How do we know when a service system is fit? Traditional metrics about the performance of individual actors and/or enterprises will not suffice. Specifically, what policies, in the light of hard-to-predict innovations, might mitigate against rapid collapse of institutional species while not mitigating the pace of innovation itself?

Policymaking

Developing the mind-sets and skills to view and act in these worlds and systems facilitates making sense of them. For example, S-D logic is one such mind-set amongst others. The emerging trans-discipline of service science, based on S-D logic, studies the evolutionary dynamics of service system entities (actors) and value co-creation phenomena (exchanges and interactions) within a nested, networked service ecology from multiple disciplinary, systems, and cultural perspectives. As entities craft new types of *value propositions* that promise shared access rights to resources, by design or by evolution (trial and error), new rules or governance mechanisms must also co-evolve to encourage collaboration, and to help resolve disputes between entities. We summarise some of these key concepts in Figure 1 (Spohrer, 2011).

Historically, institutions (service system entities) have co-evolved innovative rules alongside innovative technologies. Simon (1996) in 'Sciences of the artificial' uses the example of the design of the US Constitution as an example of rules (ensuring freedom of speech) and technology (printing press) co-evolving. More recently, the controversial proposed US legislation known as SOPA (Stop On-line Piracy Act; rules) and the rise of social media websites (technology) can be seen as co-evolving.

Figure 1 Service science: A conceptual framework.



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With respect to innovating rules, public policy schools are quick to point out that they have long embraced an interdisciplinary research approach that spans multiple disciplines, systems, and cultures, and connects to practice and action research, as only recently espoused by the emerging service science community. In fact, one of their essential tools, the Institutional Analysis and Development (IAD) framework (Ostrom, 2005), has been used by policymakers and economists around the world to analyse shared resource access, including forests and fisheries. While technological innovation is not ignored within the IAD framework, the resulting innovations and recommendation are more often new rules and new institutional structures, and not new technologies.

Prompted by a range of complex, urgent, global challenges, policymakers have begun reaching out to the emerging service science community, inviting a sharing of ideas and joint searches for new perspectives on the resiliency and sustainability of regions and the continuous improvement of quality-of-life measures within those regions.

Based on recent events and continuing dialogues, we have identified several areas for future collaboration (Spohrer, 2011). These include discussion of topics such as: (1) universities seen as a disruptive service system; (2) future cities and university-based entrepreneurial environments (U-BEE's) as nested, networked, holistic service systems; and (3) the role of rapidly advancing IT infrastructure (in global and local economic and skills strategy) viewed as a dominant driver of change across the service ecology. From these three scenarios, we conclude that academic service researchers should increase their study of the IT transformation of educational service systems at this time, and service quality researchers should both increase their study of citizens as customers/stakeholder impacted by regional quality-of-life measures and the IT transformation of government and health-care service systems. In so doing, we can better align the service science community to learn from and make contributions to the policymaking community at a time of many local and global public policy challenges, and rapid technology-driven changes, that are making the world more complex.

Discussion and conclusion

We seem hardwired to look back at our lives and institutions and reminisce that 'life was simpler then . . .'. However, we can examine our expectations of what the future could bring, as we have done in this paper, and draw several conclusions relevant to evolving service and service systems for a complex world.

First, scale or population size matters, and the first order of the complexity of the world (human ecology) is determined by scale effects – the population size of types of individuals and institutions (actors with rights and responsibilities). For example, a space-shuttle program (as an example of innovation) requires knowledge shared and distributed to a vast number of individuals and across a wide range of organisations. When adopting an S-D logic actor-centric and A2A focus (Vargo & Lusch, 2011), it is useful to make the distinction between a 'small world' and a 'big world' view.

Second, predictability matters in how we feel about complexification. Technologies and institutions simultaneously mask some aspects of the underlying complexity of the world, making it more predictable, while opening up new areas of challenge and opportunity that are novel and therefore less predictable. The awareness of the balance between routine (boredom, too entrenched, and too predictable) and challenge (too anxious, too dangerous, and too unpredictable) in various environments is fundamental to both feelings of well-being and overcoming limits (Csikszentmihalyi, 1990; March, 1991).

Third, modularity matters most in managing complexity. As the world becomes more complex, a layered modular structure that comprises tangible and intangible components (resources) and which uses protocols to facilitate the interaction of actors and resources (or resource bundles) becomes more advantageous (Lusch & Nambisan, 2012).

Fourth, ecological thinking matters to co-creating a more resilient and sustainable world. Reading, writing, and arithmetic were 'essential thinking skills' to help establish democratic capitalism in nations on the scale of millions to hundreds of millions of people with the printing press. Ecological thinking will likely prove essential thinking skills to establish a resilient and sustainable world of 10 billion people with the web and smartphones.

In sum, we conclude that evolving service systems for a complex world and building a smarter planet will require a better understanding of complexification, scale, predictability, modularity, and ecological thinking, including diversity, keystone species, generalists and specialists, nested systems, and fitness. The fundamental concepts of service science and the foundational premises of S-D logic can provide a framework for individuals and institutions engaged in creating service innovations for a complex world. However, further work is required to connect these frameworks to the study of complexity in the world (Norman, 2011) and encouraging collaborative ways of using technological and policymaking innovations to manage complexity better and improve the human condition.

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