Service Science Editorial Column, April 20, 2009: Service Science and Network Science

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Service science is a big umbrella under which many new and traditional results can find their comfortable places. However, as a creditable scientific field, it has to provide the premium that comes from the coalescence of the parts: the uniquely service science results that come from, e.g., the intersection of science, management and engineering. Jim Spohrer's declaration of interdependence (see the editorial column, *service science*, 1(1)) squarely places the focus on value cocreation in a digitally connected world. I concur (see Hsu 2009).

Connected, interdependent value cocreation is networking: the dynamic multiple connections of people, organizations, resources, and institutions as service systems which may scale down to persons, up to the whole economy, and transformational to new production functions and value chains. If we understand this networking, then we may be able to see through the business strategies and system design laws that optimize connected value cocreation.

Many physicists and mathematicians have delved into the study of networks, including both natural and artificial phenomena such as protein and social networks. Their intriguing results have amounted to the new field of network science. They have identified two major categories of networks: the so-called scale free (random) networks (Barabasi and Albert 1999) and small world (partially random) networks (Watts and Strogatz 1998). The first type reveals the formation of preferred attachment and the power laws for the number of connections at a node in a network (Newman 2005). The second helps explain the average length of connections between any two nodes in the network, among other things. Following the tradition of science, the field shows a propensity to contending to discovery *per se*, and rarely concerns themselves with design.

Some service-related fields, e.g., Information Systems, have joined network science to study social networking and other economic activities. However, by and large, service science has

not yet fully engaged this new field to further our understanding on connected value cocreation. One reason may be the fact that service systems and networks are artificial in nature and hence subscribing more to design than to discover. But more fundamentally, the state of the art may be such that network science has not yet considered the full scale of complexity of service networks, and hence hindered its application to service design. That is, relatively small scale service systems may not require network scientific results, which deal with large number of (un-regulated) nodes; and this category includes many traditional organization-bounded systems and supply chains. On the other hand, scaling of value cocreation using pervasive digital connections, such as the cases with e-commerce, are characterized with myriad of multi-layered networks, or hyper-networks; while previous network science features a scope of single layer networks.

The Internet is a prime case of hyper-networks: the same set of persons using it may constitute a virtually unlimited number of networks, each focusing on a particular task for a particular role that a person plays in his/her life cycle: as a customer for various businesses, as a provider/knowledge worker in various value cocreation systems, and as a friend, parent, child, and numerous others in his/her personal life. All these networks are logically intertwined and their actual connection across layers may be subject to business design. Both the average lengths and the power laws of single layer networks in hyper-networks may change, even drastically, when the aggregate effects of their interaction are taken into account.

In any case, it is my humble conviction that service science and network science are interdependent. When combined, the network scientific understanding of connected value cocreation may help characterize the unique nature of service science, and transform some of the previous understanding in the field. In particular, with pervasive digitization of resources and connection of all persons and all organizations to these resources becoming public cyber-infrastructure, a mom and pop store may equalize to a Google: It can afford to flexibly scale its use of the connections up to the population, down to personal needs, and transformational to

switch, combine, and redesign value chains. In fact, many such stores (e.g., buffalo chicken wings and cheese cakes) have been selling globally, buying globally, and networking customers globally.

This scaling indeed defies, for example, some traditional business strategies such as Michael Porter's low costs and product differentiation (Porter 1998). Instead of their being mutually exclusive, the hyper-networks may actually make them supporting each other. Similarly, the broad scope and narrow scope of his 2x2 matrix may co-exit, for the same company. That is, comprehensively networking with their external constituencies and of their internal production factors may blend low cost and differentiation in simultaneously broad and narrow scopes.

As evidence, search engines show that they have the entire Web for a scope and they accumulate customers and resources from the entire Internet for their business, while they personalize to attend to individual customers' needs in his/her various role in life. They also combine business designs and transform to new types such as business portals and social networking. Personalization leads to accumulation, which facilitates reuse and thereby lowers costs; while broad scope results from fluid switching and collection of narrow scopes.

We welcome the convergence of service science and network science.

References

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