Editorial: towards service science, engineering and practice[1]

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1 Introduction

Based on the Bureau of Labour Statistics, except those in the goods-producing sectors – agriculture, mining, construction and manufacturing, the service sector encompasses all other industries including transportation, logistics, communication, wholesale and retail, trade, education, finance, insurance, real estate, healthcare, criminal justice, postal operations, government and a variety of public utilities. The service industry has grown to dominate developed economies. In the US 80% of GDP in 2005 was derived from the service sector, whereas in China a rapidly growing service sector represents about 35% of the economy. Although, Chinese service industry has now contributed only 1/3 of the economy, Chinese service industry has grown in the fastest pace in the world during the last quarter century. Moreover, Chinese government aggressively responds to the service innovation opportunity by including a focus on incubating 'Modern Services' in China's 2006–2010 Five-year Plan.

In contrast to the fast service economy development, the advancement in service education and research is far left behind. According to Spohrer et al. (2007) "[t]he service sector accounts for most of the world's economic activity, but it's the

least-studied part of the economy". In 2003, US National Academy of Engineering (NAE) reported this important finding when "The Impact of Academic Research on Industrial Performance" project was completed.

According to the NAE project report (NAE, 2003), the service industry employs a large and growing share of national workforce (about 80% in the USA in 2005) and is the primary users of Information Technology (IT). Even in most manufacturing industries, the service functions (e.g. sales, logistics, distribution and customer service) focusing on increasing customer values have become leading sources for improved business competitiveness. Although, it is well understood that the rate of innovations and level of productivity in the service infrastructure (e.g. finance, transportation, communication and healthcare) have an enormous impact on the productivity and performance of all other segments of the economy, the research and education in both academics and industries are not focused on or organised to meet the needs of service businesses. It was suggested that universities and industries should immediately and appropriately address the challenges by

> "(1) adapting and applying systems and industrial-engineering concepts, methodologies, and quality-control processes to service functions and businesses; (2) integrating technological research with research in social sciences, management, and public policy; and (3) educating and training engineering and science graduates to deal with management, policy, and and social issues" (NAE, 2003).

Service is typically considered as an application of specialised knowledge, skills and experiences, performed for the benefit of another (Lusch and Vargo, 2006; Spohrer et al., 2007). Service is perishable, heterogeneous and intangible, commonly provided for either individuals or businesses to create desirable value to satisfy their needs (Dietrich and Harrison, 2006; Sampson and Froehle, 2006). Although, a significant portion of the services provided by the service industry is consumed by individuals, such as medical, education, insurance, legal, financial, transportation and retailing services, recently business services that serve different business units or organisations are growing substantially rapidly (Dietrich and Harrison, 2006). For example, technical support, enterprise resource planning, call centre operations, sales management, IT implementation, e-logistics and business investment and transformation consulting are well recognised as a highly profitable business service (Qiu, 2006a).

Driven by today's new business environment that includes advanced telecommunications, accelerated business globalisation, increased automation and rapid technology innovations, emphasis in the service sector has evolved from a traditional labour-based business to sources of innovations, collaboration and value cocreation, driving the emergence of service-value networks (i.e. service systems) at a pace never before seen in history (Spohrer and Riechen, 2006). It is obviously a trend that leading and competitive services provided by service systems are all remarkably delineated with information-driven, customer-centric, e-oriented and satisfaction-focused characteristics.

A variety of high-tech services enabled through service-value networks in the high value areas have been emerging recently, such as online information and knowledge service, IT outsourcing to post-sales training, on demand innovations consulting (e.g. work helping customers reengineer products, automate business processes, improve goods and services delivery efficiency and design and deploy supportive IT systems). In evidence, IBM Global Consulting, Accentric, Google, eBay, Amazon, YouTube,

Yahoo and online distance education well represent these emerging services. Note that traditional services providers (e.g. Airlines, UPS, Wal-Mart, McDonalds, travel agencies, etc.) are also transforming themselves into service-value networks to gain competitive advantages. It is well understood that the quality of their provided services largely depends on very large-scale public information infrastructures and complex services systems in order to satisfy the diverse needs of worldwide customers.

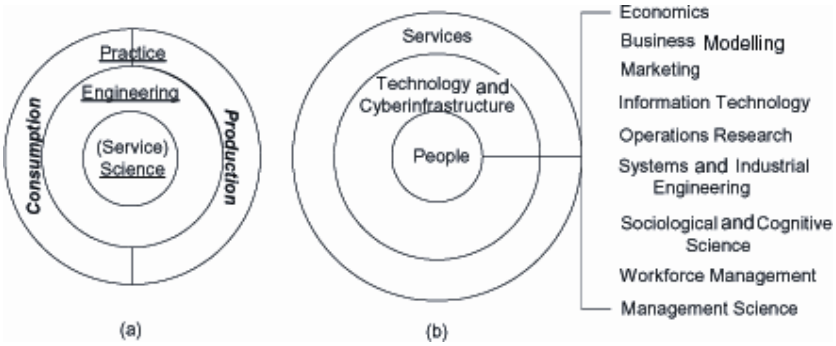
Even in manufacturing, for farsighted manufacturers in the developed economy, as their product technologies might quickly lose their competitiveness, they recognise that only their services components would distinguish themselves from their competitors. Therefore, enterprises are keen on building highly profitable service-oriented businesses by taking advantage of their own unique engineering and service expertise, aimed at shifting gears towards creating superior outcomes to best meet their customer needs in order to stay competitive (Qiu, 2006a, Rangaswamy and Pal, 2005). General Electric, IBM and many worldwide bellwethers are great examples in repositioning themselves towards the service-oriented businesses (Hidaka, 2006).

However, there is a lack of full-fledged sciences that could systematically guide the plan, design, marketing, engineering and delivery of services to meet the needs of today's changing, complicated and dynamic global service-led economy (Dietrich and Harrison, 2006; Spohrer et al., 2007). To address the needs, Figure 1 proposes perspectives of uncharted service science by illustrating that:

1 the development of service-oriented science and engineering is the key to the success of the conduct of competitive service practices (i.e. production/consumption) and

2 service systems must be *people-centric, IT-powered and market-driven*, consisting of people, technology, infrastructures and processes of service management and engineering (Lovelock and Wirtz, 2006; Spohrer et al., 2007).

Figure 1 Service science: service and service systems (a) service production and consumption: science, engineering and practice and (b) service systems: from need to delivery



It is well recognised that automation, outsourcing, customisation, offshore sourcing, business process transformation, e-business and self-services became another business wave in today's evolving global service-led economy. Although, this new wave seems to be repeating the trends afflicting US manufacturing in the 1970s, it gets more complicated while demanding higher efficiency and better cost-effectiveness across the service-value networks. Moreover, compared to industry's knowledge of mature manufacturing business practices, service

science, management and engineering is still substantially uncharted territory (IBM, 2004; Spohrer et al., 2007). Little is really known about how service science, management and engineering can be systematically applied for the efficient and cost-effectively delivery of an adaptable and sustainable service-oriented value chain from end to end.

> "The opportunity to innovate in services, to realize business and societal value from knowledge about service, to research, develop, and deliver new information services and business services, has never been greater. The challenges are both the multidisciplinary nature of service innovation, which combines business, technology, social-organizational, and demand innovation as well as the lack of formal representations of service systems" (Spohrer and Riechen, 2006).

Apparently, the economy focus shift has created a research and education gap due to the complexity of interdisciplinary issues across services business strategy and modelling, operations research, IT, industrial engineering, management science, sociological and cognitive science, workforce management and legal science, etc.

Furthermore, Spohrer (2006) articulates many reasons contributing to the slow progress of service research. These reasons includes at least the following:

> "(1) diversity of service industries and service activities in other industries makes discovery of general principles difficult, (2) misconceptions about services as low value jobs has slowed investment, (3) misconceptions about services as unproductive and resistant to productivity gains has slowed investment, (4) inability to patent or otherwise protect service innovations has slowed investment, (5) data about service phenomena that could form the basis of a general theory of service are considered confidential and proprietary and hence difficult to obtain, (6) the multidisciplinary nature of service research has meant each discipline is separately making progress rather than establishing effective collaborations and building off each others successes."

By reviewing certain state-of-the-art research in service, this editorial paper presents one point of view towards the science of service and service systems. Instead of simply providing a compressive literature review in service, the editorial aims to call for more worldwide discussion, education and research in service. Hopefully, the articulated concerns in this editorial would help draw much more attention from scholars, managers, engineers, practitioners and policymakers around the world. Ultimately the theory and principles towards engineering, operating, managing and evolving service systems would then be comprehensively explored and developed, resulting in the fast fulfilment of the education and research gap in service identified by NAE (2003) to meet the challenges in the service-led economy.

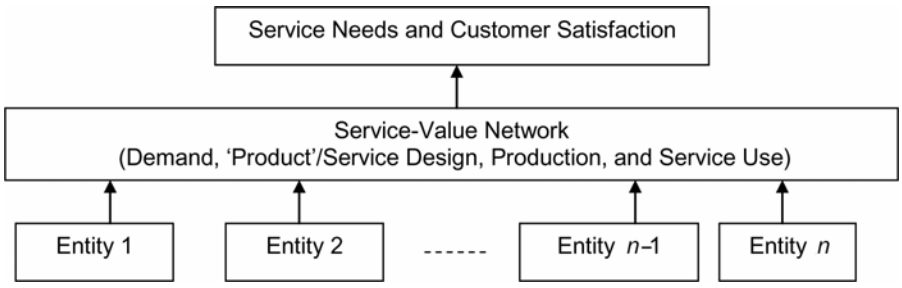
2 Towards service science, engineering and practice

By end of the day, the value of delivered individual or business services lies in its ability to satisfy an end user's need, which is not simply and strictly seen in the technical characteristics of the services and the physical attributes of the associated products in the services. It is not a secret; that the quality services essentially lead to high customer satisfaction. Satisfaction characterised as a superior outcome then further drives customer

decisions. It well concurs with Prof. Roland Rust's remark, "[today's] business reality is that goods are commodities; the service sells the product". Apparently, the service-oriented total solutions measured by performances for the customer's final benefit rather than the functionality of physical goods become the prime competition in the global service-led marketplaces (Rust, 2004).

The competency of service providers to deliver superior outcome to the end user inevitably relies on the capability of engineering, performing and managing quality of services throughout the entire service-value network. As seen in Figure 2, no matter what service is provided for whom, an entity of individuals or businesses, whether the need is fully met and the customer completely satisfied relies on the efficient and effective operations of the service-value network, that is, an integrated heterogeneous service system. Entities in the service-value network are service providers and clients; they could be individuals or businesses (e.g. companies, institutions, governmental agencies). It is widely recognised that competitive service systems are value coproduction configurations of people, technology, internal and external service systems connected by value propositions, shared interest and information (languages, customs, regulations and metrics) (Dietrich and Harrison, 2006; IBM, 2006; Spohrer et al., 2007).

Figure 2 Schematic view of a service-value network

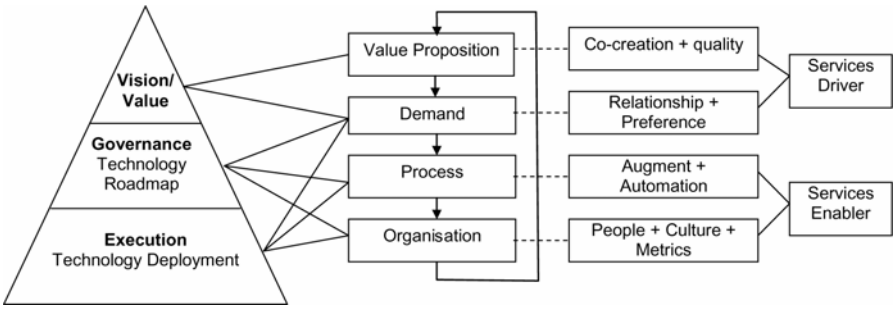


Source: Qiu (2006a).

With the help of on-going 'industrialisation' of the information technologies, enterprises must aggregate products and services into total solutions by implementing integrated and complete value chains, which optimally deliver their services through the exchange of intangible resources, the cocreation of value and relationships. The essential goal of applying total solutions to service-value networks is to enable the discovery, design, deployment, execution, operation, monitoring, optimisation, analysis, transformation and creation of coordinated business processes across the whole value network. Ultimately, the profit across the whole service-value network can be maximised as it becomes the top business objective in today's global business environment (Karmarkar, 2004).

Innovations are the key to stay a step or two ahead of competitors. New service delivery models are essentially derived by working closely with customers to cocreate innovative and unique solutions best meeting customer inevitably changing needs. According to Rangaswamy and Pal, a service innovation framework (IBM, 2004) is critical for service business operations and management to stay 'outperform' (Figure 3). "The framework can guide the creation of customer value and demand, and the processes and organizations that deliver services successfully – all of it catalyzed by emerging technologies" (Rangaswamy and Pal, 2005).

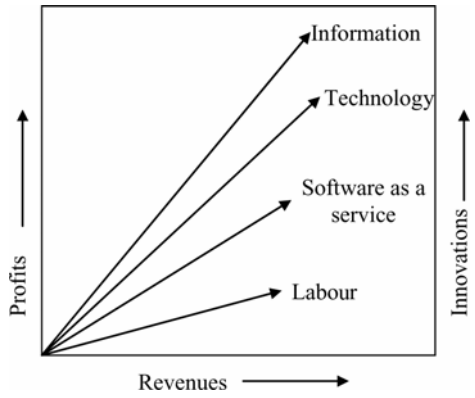
Figure 3 Service innovations framework



Source: Rangaswamy and Pal (2005) and Qiu (2006a).

Consequently, enterprises nowadays have to rethink their operational and organisational structures by overcoming a variety of social and cultural barriers, so as to ensure the prompt and cost-effective delivery of innovative and satisfactory service for customers throughout the geographically dispersed value network. Challenges appear in many aspects from business strategy, marketing, modelling, innovations, design, engineering, to operations and management. When a service system integrates different types of resources, it generates different scales of revenues and profits, most importantly different competitiveness staying in the marketplace (Figure 4). It is essential to develop the science capable of helping enterprises invest effectively to realise a competitive configuration of service systems under circumstance and realise more predicable outcomes.

Figure 4 Outcomes scale of service systems with different configurations



Source: Spohrer et al. (2007).

In summary, to help service providers maximise the profit across the whole service-value network (Figure 2) with a competent while competitive configuration (Figure 4) by employing materialised and concrete service innovation framework (Figure 3), Services Science (Figure 1) should be comprehensively studied and developed. Surely a well defined and developed Service Science will scientifically facilitate crafting and measuring service productivity, quality, compliance, operations and innovations throughout the lifecycle of services across the service-value networks.

3 A call for comprehensive and collaborative service research

As stated earlier, in spite of the dominative role of services in today's economic activities, research on understanding how enterprises could invest effectively to create service innovations and realise more predicable outcomes has made a little and slow progress, which could be a big obstacle for the developed countries to develop and sustain their future service-led economic growth (Dietrich and Harrison, 2006; Hidaka, 2006; Lovelock and Wirtz, 2006; NAE, 2003; Spohrer, 2006; Spohrer et al., 2007). Ironically, there is even a lack of a widely accepted definition of service, not to mention the unified theory and principles towards engineering, operating and managing service systems.

Note that today's service concept evolves beyond the traditional non-agricultural and/or non-manufacturing performance for the consumer's benefits. For example, many new emerging high value areas, such as IT outsourcing to post-sales training, on demand innovations consulting (including knowledge services helping customers improve their products, business processes, goods and delivery and IT systems), are well recognised as a service (Fitzgerald, 2005; Rosmarin, 2006). Although, little progress has been made yet in service and service systems as a whole, research work in pieces has been separately done in many disciplines for years. It is worthy to know where we are in order to know where we are going.

By exploring the marketing shift from the exchange of tangible resources, embedded value and transactions based 'goods' to the exchange of intangible resources, the cocreation of value and relationships based 'service', Vargo and Lusch (2004) argue for the necessity of evolving a service-dominant logic in marketing to replace the goods-dominant logic. They emphasise that general concepts, worldview and small set of fundamental propositions, along with their empirical support, about the service should be established. They have comprehensively reviewed literature in the relevant areas and present the foundational premises of the emerging service paradigm:

> "(1) skills and knowledge are the fundamental unit of exchange, (2) indirect exchange masks the fundamental unit of exchange, (3) goods are distribution mechanisms for service provision, (4) knowledge is the fundamental source of competitive advantage, (5) all economies are services economies, (6) the customer is always a coproducer, (7) the enterprise can only make value propositions, and (8) a service-centered view is inherently customer oriented and relational."

Vargo and Lusch articulate that the essential concept of 'service' should be defined as the application of competences for the benefit of another entity and the term 'service' focusing on a process rather than 'services' implying 'intangible goods' should be used given that the service value is always cocreated during its production. Through further identifying intangibility, heterogeneity, simultaneity, perishability, customer participation and coproduction as key commonalities across disparate services businesses, Sampson and Froehle (2006) present the need for a Unifying Services Theory (UST). They particularly argue that the presence of customer dynamic inputs is necessary and sufficient to define a service engineering process, which is why service processes are typically harder to manage than goods production processes. Their investigation focus on revealing some principles common to a wide range of services and providing a common ground for further theoretical exploration of capacity and demand management, service quality, service strategy and so forth.

As stated earlier, service systems produce and consume services. As competitive service systems must be *people-centric*, *IT-powered and market-driven*, consisting of people, technology, infrastructures and processes of service management and engineering, Jim Spohrer proposes that a general theory of service should broadly consist of three bodies of knowledge (Spohrer, 2006), including

1 *The fundamental understanding of service systems and their services*: the origins of new service systems and new services, interactions, the role of people, technology, shared information, as well as the role of customer inputs in production processes.

2 *How to improve service systems*: the ways a service system improves or evolves over time through further investments, including improving efficiency (improved plans, methods and techniques), effectiveness (improved measures, goals, purpose and key performance indicators) and sustainability (improved value proposition results, robustness and versatility).

3 *How to scale service system*: the ways improvements (new competencies) in one service system can be spread (scale out and scale up) to other service systems to create a synergistic effect.

According to Wood (2006), business and professional services especially in the high tech areas are the fastest growing part of the service economy. However, service research in this area is under represented in the service research literature. Using 'IT as a service' as an example, Qiu (2006b) elucidates that, to ensure the prompt and cost-effective delivery of innovative and satisfactory IT services for customers throughout the geographically dispersed service-value networks, enterprises nowadays have to overcome a variety of challenges across many aspects from service business strategy, marketing, modelling, innovations, design, engineering, to service operations and management.

By comparing services to manufacturing and supply chain systems, Dietrich and Harrison (2006) state that in general it lacks sufficient modelling of services due to the fact that service research is confronting more challenging issues. Compared to physical goods in manufacturing and supply chain systems, resources, largely people, cannot be held and are more complex to model as people participating in service production and consumption have physiological and psychological issues, cognitive capability and sociological constraints. They propose a variety of research issues to which operation researchers potentially can contribute.

In a broader view, service cannot be in inventory and are typically intangible, perishable, difficult to port, hard to measure and coproduction with customers. Thus, competent and competitive service systems should be highly adaptable and sustainable to the service environment (when, where and who to deliver and whom to be served, etc). Service systems then should be well defined and developed through well understanding of the following:

1 *Service demand/marketing*: need, perception, value and satisfaction spanning from varieties, market acceptance, penetration and potentials, competitiveness and economic benefits, to beneficial opportunities in the long run. (Research areas include *Service Dynamics and Strategy*, *Service Marketing*, *Service Pricing*, *Capacity and Demand Management*, *Service Innovations* and so forth).

2 Service environmental settings
   a *Service consumer's environmental setting*: value proposition, customs, languages, cultures and regional regulations, etc.
   b *Service provider's environmental setting*: workforce management, labour relationships, human behaviour, skills/training, knowledge transfer, etc.
   c Human interfaces and interactions (psychological and physiological). (Research areas include *Service Engineering, Service Operations and Productivity, Customisation versus Standardisation, Workforce Management* and so forth).
3 *Adaptable and sustainable service engineering process*: resource alignment (e.g. workforce management), operations function and value, hybrid designed (artificially) and evolved (naturally) to meet the diverse needs of service environmental settings (coproduction). (Research areas include *Complex Adaptive Service Systems, Service Process Engineering, Service Operations and Productivity, Service Delivery, Workforce Management* and so forth).
4 *Large-scale information infrastructure*: a complex and integrated system that can evolve over time to optimally support the defined service engineering processes, aimed at the delivery of needed data, information and knowledge to the right user at the right time. (Research areas include *Complex Adaptive Service Systems, Information and Knowledge Systems, Service-Oriented Enterprise Information Systems* and so forth).
5 *Effective management and efficient organisation*: planning, design, execution and reengineering of the defined complex and adaptable services systems. (Research areas include *Quality, Risk and Management, Service Innovations Framework, Service Benchmarks, Business Transformation* and so forth).

Despite the recognition of the importance of service research, the shift to focus on disparate and global-scale services in the information era has created a research gap due to the overwhelming complexity of interdisciplinary issues across service marketing, service-oriented business modelling, information technologies and workforce management. Filling the gap is essential.

> "We can move the field forward not only by understanding and serving the customer but by designing efficient systems of service delivery; training and motivating service providers; using new service technologies; and understanding how service affects the marketplace, the economy, and government policy" (Rust, 2004).

Surely a better defined and more advanced Service Science would better facilitate crafting and measuring service productivity, quality, compliance, operations and innovations throughout the lifecycle of services across the service-value networks. This editorial calls for comprehensive and collaborative Service Research worldwide in all above discussed areas.

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Note

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