

The Case for Service Science, Engineering and Management Research

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Introduction and Background

There is now wide agreement that the U.S. economy has entered a new phase wherein the production of and delivery of services has surpassed manufacturing as the largest component of the nation's gross national product. In the U.S. individual consumers as well as firms, large and small, procure a vast array of services. Certainly more new jobs are being created in the service sector than in traditional manufacturing enterprises. Innovations in computing technologies, such as web services and service-oriented computing architectures, provide a striking parallel to this phenomenon.

With the aforementioned growth of the service sector comes a host of new phenomena. Foremost among these is the emergence of what may be called service enterprises, which are firms or institutions that possess some unique features that distinguish them from traditional firms and institutions. These include both physical and virtual services, as well as recasting of existing ways of doing business that introduces a service component. In fact, some or all of the following features will be manifested by most service enterprises:

1. service enterprises tend to hold little output inventory of physical services, in the sense that their output in most cases is 'perishable';
2. service enterprises participate in potentially fierce competition, primarily by setting prices and by influencing consumers' learning processes regarding available services;
3. the order of entry of service enterprises into a given service market is often very important to competitiveness and long-run success;
4. service enterprises are highly sensitive to technological advances in service provision, making long range planning very difficult;
5. bundling of physical and virtual services presents significant opportunities for effective and efficient management of lines of business in a number of ways, both to improve internal efficiencies as well as to offer innovative services to customers; and
6. the fixed costs of service enterprises are substantially larger than their variable costs, and frequently their variable costs are highly structured.

An Emerging Consensus

The scholarly community has recognized that maintaining a service firm's competitiveness or a service institution's rank in the face of the special properties of service enterprises mentioned above poses a significant challenge that may be best addressed using quantitative and computational tools. Specific observations supporting this point of view are the following:

1. As a case in point, the Institute for Operations Research and the Management Sciences (INFORMS) publishes a journal entitled *Manufacturing & Service Operations Management (M&SOM)* that promotes scholarly discourse and research on the service sector from both the point of view of service providing firms and service procuring firms.
2. The field of inquiry and practice known as supply chain management (SCM) frequently takes the form of a service offered by a specialized external enterprise to enhance some firm's efficient acquisition of those input factors it needs for production.
3. Many firms elect to have their products delivered to wholesale and retail markets by specialized transportation, distribution and logistics (TDL) service firms. In some cases such external TDL firms take charge of virtually all transportation, distribution and logistics associated with a client firm's presence in its output markets.
4. Revenue management (RM) is another relatively new field that may be thought of as a co-discipline of the MSOM field. In RM one concentrates on revenue maximization since costs are largely fixed, while in MSOM one maximizes profits either alone or in combination with other investment criteria. Revenue management stresses dynamic price discrimination to extract all unused willingness to pay from service consumers.
5. Still another new field that is directly relevant to service science, engineering and management is financial engineering (FE), which focuses on the pricing of both financial options and real options. Moreover, the theory of real options is now being used to value flexibility (defined as the ability to respond effectively to unanticipated events) in both manufacturing and service provision.
6. There is also a growing recognition that most realistic MSOM, SCM, TDL, RM and FE problems arise in a dynamic environment. The reason for this is relatively obvious: exploitation of technological innovations to save time make timing a critical aspect of every transaction.
7. Service computing and service-oriented architectures (SOA) are increasingly seen as essential elements to support the design and deployment of virtual services either on their own or in combination with physical services.
8. In addition to the service enterprise engineering topics of inquiry and discourse mentioned above, there are a number of additional service engineering activities that are continually present in the U.S. economy, including but not limited to the following:
 - a. security (S)
 - b. hospitality and leisure (HL)
 - c. telecommunications (TC)
 - d. healthcare (HC)

Taken together, the above observations help to define the human resources needed to create a successful service research program, namely experts in optimization, simulation, stochastic processes, dynamic systems and control, engineering economy, computational science and financial engineering as well as specific technologies that are at the heart of the MSOM, SCM, TDL, RM, FE, S, HL, TC, and HC application domains discussed above.