BY JERRY SHEEHAN

UNDERSTANDING SERVICE SECTOR INNOVATION

The future of the service economy depends on worldwide appreciation, dedication, and encouragement of innovation as a key component.

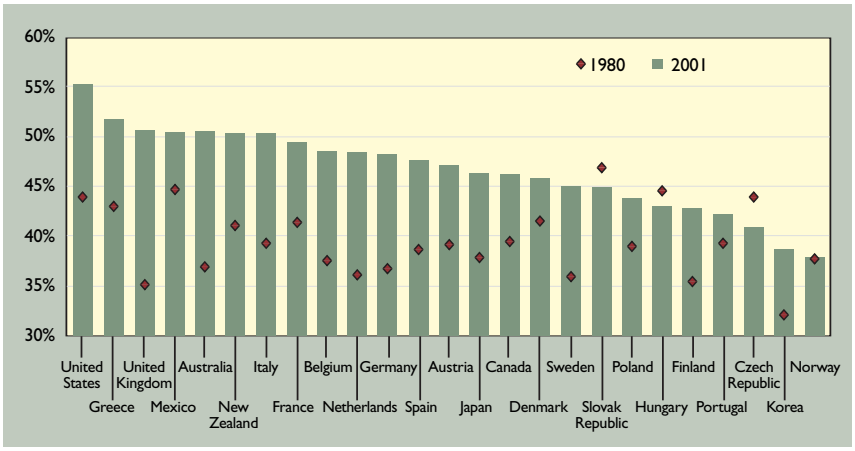
ervices play a key role in developed economies. Industries that deliver help, utility, experience, information, or other intellectual content have expanded rapidly in recent decades and now account for more than 70% of total value added in the Organisation for Economic Co-operation and Development (OECD) countries.[1] Market-based services (that is, excluding those typically provided by the public sector, such as education, health care, and government) account for 50% of the total and have become the main driver of productivity and economic growth in OECD countries, especially as use of IT services has grown (see Figure 1).[2] Services have also emerged as the main source of job creation in OECD countries, often compensating for job losses in manufacturing. Business services, such as computing, information services, and R&D services, generated more than half of all employment growth in many countries in recent years. Moreover, they help improve the competitive performance of firms in virtually all sectors of modern economies.

[1]The OECD has 30 member countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, U.K., and U.S. (See www.oecd.org.)

[2]Business services include the renting of machinery and equipment, computer and related activities, R+D, and other business services. Market services include wholesale and retail trade; hotels and restaurants; transport and communications; financial intermediation; and real estate, rentals and business services. Total services include market services plus public administration, health, education, and other community, social, and personal services.

ILLUSTRATION BY LISA HANEY

Several factors contribute to the expansion of the service economy. At the macroeconomic level, increasing manufacturing productivity and growing competition from developing countries limit employment growth in manufacturing and motivate efforts to focus on higher value-added activities. At the firm level, rising investment in intangibles, growing emphasis on knowledge management, a renewed focus on core competencies, and outsourcing play major roles. Within the manufacturing sector, services previously produced in-house are now obtained via outsourcing. By the mid-1990s, services accounted for nearly 25% of the value added embodied in final demand for manufactured goods, compared to 15% or less in the early 1970s. In most countries, manufacturing relies more heavily on telecommunications, business, and computer services with a view to stimulating greater productivity. Manufacturing firms have also moved to more closely link products to services by providing their clients with integrated product-service packages and integrated solutions rather than traditional products [69].



Source: OECD, *STI Scoreboard 2003*.

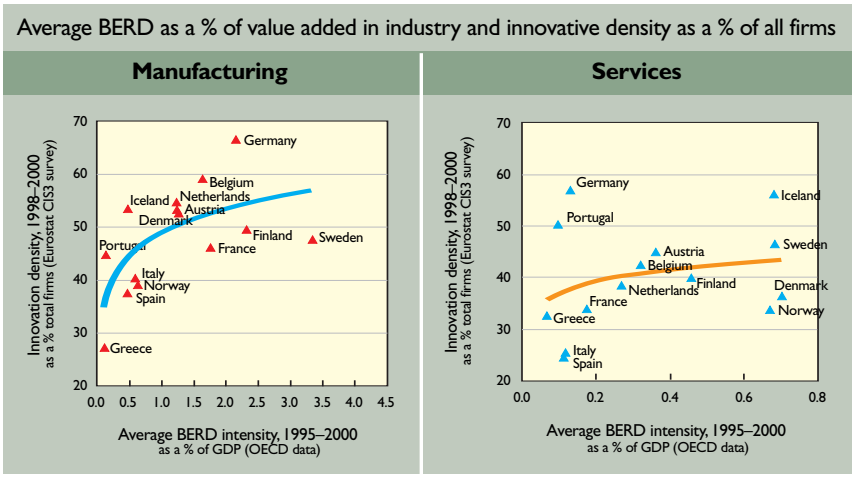
Figure 1. Share of market services in total value added, 1980 and 2001.

The growing importance of services in the economy implies that efforts to improve standards of living, boost productivity, and create jobs must focus increasingly on the service sector. Whereas the service sector has often been characterized as a locus of low wage, unproductive, and un-innovative jobs, recent evidence gained through innovation surveys and better statistical data discredits this view, confirming that services are indeed innovative and, in some areas, more innovative than manufacturing [102]. In fact, knowledge-intensive services, whose value added is intangible rather than incorporated in physical products, play an increasingly dynamic and pivotal role in today's knowledge-based economy, contributing to innovation in all economic sectors [69]. Firms in the telecommunications, finance, and business services have among the largest investments in R&D in the service sector and a strong reliance on highly skilled workers. Policymakers will need to determine how best to stimulate the growth of these sectors and to enhance the development and exploitation of knowledge in other service-sector industries. In other words, they will need to determine how best to promote innovation in services.

Services Firms Innovate, but Differently

Innovation has long been recognized as a key to economic growth [67], but its role in the service sector has been underappreciated, in part because of data limitations. In recent years, a number of surveys have made it increasingly clear that service-sector firms are innovative, but with patterns of innovation that differ from those in the manufacturing sector. In the third Community Innovation Survey (CIS3) administered in 15 European countries, the share of service-sector firms reporting they had introduced a new product or process between 1998 and 2000 ranged from about 25% in Spain to more than 55% in Germany. Comparable figures for manufacturing firms were 40% in Spain and 65% in Germany. Recent innovation surveys in Australia, Japan, Korea, and New Zealand show similar results, with between 18% and 40% of services firms reporting innovation, compared to between 25% and 50% of manufacturing firms.

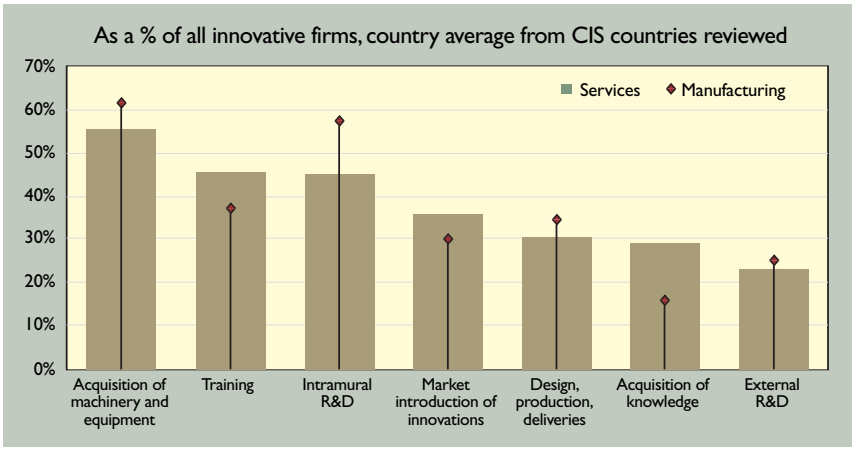
Rates of innovation vary considerably across different parts of the service sector. In the CIS3 survey, more than 60% of business services firms and 50% of financial services firms reported they were innovative, compared with only 40% and 30% of firms in wholesale & retail trade and transport & communication, respectively. For comparison, just under 50% of all manufacturing firms reported they were innovative. Similar patterns were found in Japan, where business services, communications, and financial intermediation firms were more likely than manufacturing firms to indicate they had been innovative. In Australia, too, the share of innovative firms in communication services exceeds that of the manufacturing sector. Uniformly, large service-sector firms are considerably more likely to be innovative than small firms.



Source: OECD [68], based on data from Eurostat, CIS3 Survey and OECD ANBERD Database, 2004.

Figure 2. Link between R&D and innovation in manufacturing and services.

Innovation processes differ somewhat between service and manufacturing firms. In general, innovation in the service sector relies less on in-house R&D than in the manufacturing sector. Whereas countries with high levels of R&D in their manufacturing sectors (measured as a share of value added) also have high shares of innovative manufacturing firms, this relationship does not hold for the service sector (see Figure 2). Germany, for example, reports very high rates of innovation in the service sector, but low levels of R&D spending as a share of value added in services. Conversely, reported rates of innovation in Denmark and Norway are below the European average despite high relative levels of spending on services R&D.



Source: OECD [68] based on data from Eurostat, CIS3 Survey.

Figure 3. Activities that contribute to innovation.

These statistics do not mean that R&D is not important to service-sector firms, but that other factors also play a significant role in service-sector innovation. Indeed, in innovation surveys, both manufacturing and service firms rank acquisition of machinery and equipment as the primary activity underlying innovation. Manufacturing firms rank internal R&D a close second, whereas service firms rank worker training higher (see Figure 3), reflecting the fact that market services employ a larger share of workers with higher education than manufacturing—by a factor of two in many countries. Service firms also tend to report higher reliance on the acquisition of knowledge from external sources (for example, through patent licensing), although they are about as likely as manufacturing firms to finance external R&D.

Of course, innovation processes differ from one service-sector industry to another. Business services and financial intermediation firms use virtually all mechanisms of innovation more than firms in other service industries. The largest differences arise with intramural R&D and training. In the CIS3 survey, approximately three-quarters of business services firms reported they conducted intramural R&D, compared to 45% or less of firms in other service industries and less than 60% of manufacturing firms. Some 60% of business service and financial intermediation firms engage in training,

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compared to about 40% of other services firms and 38% of manufacturing firms. Such figures suggest that policies aimed at improving service-sector innovation will have different effects on different sectors. They also suggest that some portions of the service sector—particularly business services—innovate in ways that are more similar to high-technology manufacturing firms than to other service-sector firms.

Indeed, as the business services sector expands, service-sector investments in R&D appear to be rising. Between 1990 and 2001, service-sector R&D increased at an average annual rate of 12% across OECD member countries, compared to approximately 3% in manufacturing. While a portion of this growth results from improved measurement of R&D in the service sector and a reclassification of some R&D-intensive firms from manufacturing to services, it also reflects real increases in R&D by service-sector firms, driven by competitive demands or by increased outsourcing of R&D by other firms. But services R&D remains highly concentrated. In most countries, business services and post & telecommunications account for more than three-quarters of all service sector R&D. Within these broad categories, computer and related services, R&D services and telecommunications services account for almost the entirety, as well as for most of the growth in R&D intensity over the last decade.

The Role of IT

IT contributes to service-sector innovation far beyond its role in the computing and telecommunications services sectors. Acquisition of machinery and equipment is a key source of innovation in all service-sector firms, and IT-related expenditures have been the most dynamic component of fixed capital investment in recent years. The share of IT in total non-residential investment doubled—and in some countries quadrupled—between 1980 and 2000, with software as the fastest-growing component. In Sweden, Denmark, and the U.S., software accounted for over 15% of total investment in 2000.

Patent statistics provide further evidence of the importance of IT in service-sector innovation. On average only about 5% of all service sector firms in the CIS3 Survey reported they used patents to protect their competitive advantage. In half of the surveyed countries, however, between 10% and 30% of the innovative services firms owned a valid patent, compared to 20% to 35% of innovative manufacturing firms. Large shares of these patents relate to IT and software inventions. More than 90% of the patents filed by eight large financial services firms examined by the OECD belonged to patent class G, which covers inventions for computing, calculating, and counting, including software-related inventions. More than 70% of the patents filed by nine business services firms studied by the OECD were in class G, even though the list of business service companies contained only one pure software producer.

Service-sector firms also file for business method patents, which can be broadly defined as new ways of doing business, often involving computer-based implementations of business functions.[3] In the U.S., holders of business method patents include R&D-intensive manufacturing firms with large patent portfolios, as well as IT service providers, Internet-based retailers, business consulting firms, and financial services firms. These firms have small patent portfolios overall, of which business-method patents usually represent a two-digit share. Among the business-method patents awarded to the top 100 business-method patentees, 42% were held by companies offering IT equipment and services, 17% by electric equipment manufacturers, and 16% by mail equipment and services firms. Telecommunications equipment and services firms account for 9% of the patents, and firms in other service sectors, including financial services, hold about 15% of all business-method patents.

Policies for Promoting Innovation in Services

Despite the growing importance of services, they have to date been virtually absent from discussions of national innovation policy. Few OECD countries have policies or programs that focus specifically on service-sector innovation, and few service firms participate in more general innovation support programs. A recent study in the Netherlands found that only 7% of innovative service firms with fewer than 10 employees made use of innovation incentives offered by the Dutch government [49], and innovation surveys reveal the share of services firms receiving public funding is considerably lower than that of manufacturing firms, often 40% or 50% lower.

A few countries are nevertheless developing innovation policies that focus on services. In Finland, for example, the Ministry of Trade and Industry's guidelines for innovation policy recognize the importance of services and the need for balanced development of innovation in all sectors. The Finnish funding agency for technology and innovation, Tekes, recently announced a €100 million program for services

[3]Business method inventions tend to be classified at the USPTO under patent class 705, *data processing: financial, business practice, management or cost/price determination.* The number of business method patents granted in the U.S. grew rapidly after 1998, but remains a small fraction of all USPTO patents (0.63% in 2000). In Japan, the number of business-method patents applications grew rapidly in the late 1990s, but patent grants remained constant at about 200 per year.

R&D. The National Science Foundation also has a program on Service Enterprise Engineering that investigates the design, planning, and control of operations and processes in commercial and institutional service enterprises. In Ireland and Norway, work is also under way to identify obstacles to service-sector innovation and provide necessary encouragement. In China, too, the State Council prepared a set of "Comments on Policies and Measures to Accelerate Development of Service Industry during the 10th Five-Year Period," and the country is studying the feasibility of tax policies to encourage innovation in services. In a number of countries, policies aim to encourage service-sector innovation by fostering the development and use of IT.

Education policies will have a significant effect on service-sector innovation given the sector's dependence on highly skilled workers. Efforts must focus not only on increasing overall numbers of university graduates, but on improving relevant skills to bring to the job. While considerable attention has been paid to the development of IT-related skills, education that matches scientific and technical skills to the needs of the service sector may also be needed. In the U.S., 61% of the 2.7 million employed scientists and engineers worked in the services sector in 1998 [66], up from 45% in 1980. Some 40% of them worked in the financial intermediation and business services sectors, and many held degrees in computer science, highlighting the applicability of their skills to such domains. Cooperation with the private sector can help to ensure that education programs remain relevant to industry needs and keep pace with developments in fast-moving fields, such as IT.

Research funding can also play an important role in stimulating service-sector innovation. For example, research could help solve problems that computing and telecommunications service providers face in managing and ensuring the reliability of complex systems. Research could also aim at better understanding the non-technical aspects of service-sector innovation, in particular organizational innovation, drawing on advances in the social sciences and management. Work could also explore challenges associated with the application of IT to innovative service industries, such as health care, finance, and education [26]. The focus of such work would not be development of specific software applications for these domains, but the solution of more generic, complex research problems that would demand multidisciplinary expertise in IT, management, health care services, education, and the social sciences. Greater emphasis on technology diffusion, to help spread innovative approaches throughout the highly fragmented service sector, could also enable advances in productivity [3].

While such efforts are no substitute for a business environment that rewards innovative services firms and allows them to flourish, they will become increasingly necessary steps for ensuring that service sector firms have the knowledge and human resources they need to innovate. To the extent that future productivity and employment growth depend on the success of service industries, greater policy attention will need to be dedicated to this sector of the economy. Paying more attention to service-sector innovation could yield large dividends for the economy and society as a whole. C

Education policies will have a significant effect on service-sector innovation given the sector's dependence on highly skilled workers. Efforts must focus not only on increasing overall numbers of university graduates, but on improving relevant skills to bring to the job.

A complete bibliography of the literature used in the course of preparing the articles for this special section on services science is available on page 33.

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BY *JOHN ZYSMAN*

We are in the midst of the fourth services transformation. The core story is the application of rule-based IT tools to service activities; it is not about the growth in the quantity or the value of the activities we label as services. The application of IT has the potential to transform the services component of the economy, altering how activities are conducted, and value is created. Services were once seen as a sinkhole of the economy, immune to significant technological or organizationally driven productivity increases. Now the IT-enabled reorganization of services, and business processes more generally, has become a source of dynamism in the economy.

There are four interconnected service stories that must be separated and clarified. The first is an accounting error, or perhaps better, a matter of financial engineering. Activities outsourced from manufacturing are relabeled as services. The GM window washer is a manufacturing employee; but when contracted by GM he becomes a service employee. The same window is washed, perhaps by the same window washer. Initially, at least, we should assume the activities stay the same, just conducted by different organizations.

The second story is that services become a larger part of the economy with the evolution of consumer and business purchases. Services have become a larger portion of both the consumer market-basket and of what businesses use to produce and distribute their goods and services.

The third service story is about the transformation in and changing role of women in the work force and, with that, the conversion of unpaid domestic work—washing floors, watching babies, and delivering groceries—into commercial services bought and sold in the market. It is a form of household outsourcing.

The fourth service story is the digital or algorithmic transformation. Service activities themselves are changed when they can be converted into formalizable, codifiable, computable processes with clearly defined rules for their execution. This is an algorithmic service transformation facilitated by IT tools. Much of the service innovation then is around the adoption and effective implementation of IT tools. Certainly business processes from finance and accounting through to customer support and CRM are altered when they can be treated as matters of information and data management. Routine and manual functions are automated, and fundamental reorganization of activities is enabled. Likewise, sensors and sensor-based networks change many personal services. Then, as service activities are conducted by and with IT tools, the worker skills required change as well. And of course, as information moves, many activities that were previously tightly linked to particular places can be moved.

Just as important, this algorithmic transformation blurs the line even further between product and service. For example, it is conventional to observe that products such as media products are simply encapsulated information. Conversion into digital format facilitates their online delivery to computers, cell phones, iPods, and the like. Slowly the particular product, the purchase of a CD, blurs into a service, a subscription to download music. IBM has transformed from a company selling a product in which service support provided competitive advantage into a service company embedding products in its offerings. The services that ride on the product platform become the differentiated asset that creates value for the firm.

The drama is that tools and technologies based on algorithmic decomposition of service processes may have the power to revolutionize business models the way manufacturing was revolutionized in the industrial revolution. The digitally implemented service processes and activities will displace people when it is embedded in automated processes, but often complement the effective use of human insight, intelligence, and knowledge in the choice, development, application, and effective use, of these tools will remain central. The crucial issue in this era will be how underlying knowledge and insight is developed and applied. C

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