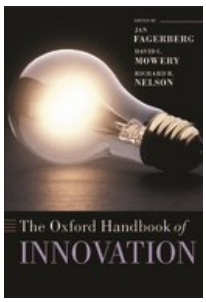

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CHAPTER

16 Innovation in Services

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Abstract

Service innovation now occupies a more prominent position in innovation studies over the last few years, but this has yet to be reflected in an accumulation of knowledge about services in innovation policy. Services innovation is a topic of growing interest for innovation researchers and policy makers alike. This has particularly been so in the last decade, as services have grown to constitute the larger part of employment and output in most industrial countries. The services sectors of these economies are important for their productivity, economic competitiveness, and quality of life. But innovation in services is important for other reasons beyond the economic importance of the sector. First, innovation in services extends beyond the services sectors to affect service activities in all sectors of the economy. Second, some services play central roles in innovation processes throughout the economy.

Keywords: service innovation, innovation policy, industrial countries, productivity, economic competitiveness

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16.1 Introduction

SERVICES innovation is a topic of growing interest for innovation researchers and policy makers alike. This has particularly been so in the last decade, as services have grown to constitute the larger part of employment and output in most industrial countries. The services sectors of these economies are important for their productivity, economic competitiveness, and quality of life. But innovation in services is important for other reasons beyond the economic importance of the sector. Innovation in services extends beyond the services sectors to affect service activities in all sectors of the economy. Second, some services play central roles in innovation processes throughout the economy, as agents of transfer, innovation support, and sources of innovations for other sectors.

16.2 Services—Growth, Characteristics, and Innovation

Output and employment in the service sectors have grown significantly throughout the industrial world since the 1950s. Table 16.1 shows that as early as the 1970s, services ↳ constituted more than half of the value added in European Union countries, and by the new century they contributed over two-thirds.

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Table 16.1 Share (%) of gross value added in services in total GDP in EU countries

	EC-9 (1973)	EC-10 (1981)	EC-12 (1986)	EU-15 (1995)	EU-15 (2001)
EC/EU	50.7	56.3	59	63.1	65.3
Ireland	44.5	49.4	50.4	48.6	49
Finland	n/a	49.8	53	56.4	57.1
Portugal	n/a	48.8	54.1	59.1	61
Austria	n/a	55.5	58.6	63.3	63.6
Denmark	58.8	60.9	60.3	64	64
Spain	47.8	57.3	58	63.7	64.2
Germany	48.1	54.2	55.9	62.5	64.9
Italy	51.1	56.4	60.6	62.8	64.9
Greece	40.3	47.7	48.9	62.6	65.4
Sweden	n/a	60.1	59.7	62.2	65.5
Netherlands	52.2	58.8	60.4	63.9	65.5
France	50.8	57.4	61.1	65.3	66.8
UK	54.7	54.5	57.1	62.1	67.2
Belgium	54.6	60.7	62.8	66.1	67.3
Luxembourg	46.9	65.2	76.4	83.7	83.8

Source: Eurostat (2003), *50 years of figures on Europe*, Luxembourg: European Communities.

16.2.1 Services Diversity—and Distinctiveness

The rates of growth in services output and employment vary among the nations in Table 16.1, and in the case of Ireland, the share of output attributable to services declined during 1986–2001. These differences reflect contrasts in the composition of the services sector in different countries, highlighting the fact that the category "service sector" comprises a huge range of different activities with very different characteristics. At one extreme are personal services like hairdressing that involve basic technologies and often are organized on a small-scale basis. In contrast, the FIRE (finance, insurance, and real estate services) sector is dominated by very large firms using advanced information technologies intensively. Other technologies are used in distributive services, which include transport in all its varieties and retail and wholesale trade and,
p. 435 in some classifications, telecommunications and broadcasting. ↳ HORECA (hotels, restaurants and catering) is dominated by food preparation and delivery, and includes other elements of hospitality, entertainment, and comfort. Social and collective services such as public administration and health and educational services are delivered largely or entirely through the state, though patterns of organization vary a great deal over time and across countries: the back-office operations of such bodies can be highly IT-intensive. Business services include practical support with logistics and office and building services, as well as support for administrative matters (such as law and accountancy) and technology support, such as computer and engineering services. This summary by no means exhausts the variety of activities and technologies included in the services sector.

Services markets also are diverse, spanning consumers, businesses, and the public sector and its clients. The transformations effected by these services industries operate on such diverse "raw materials" as human clients (as well as some other biological organisms, e.g. veterinary services), physical artifacts (they may be repaired, maintained, stored, transported, tested, integrated into larger systems ...), and data, symbols and information (that may be processed, stored, telecommunicated, etc. by services like financial industries as well as by computer and communications services, etc.). The technical skills demanded of the workforce range from the minimal ones used in fast food outlets and office cleaning to the professional qualifications of market researchers and architects, and the scientific and engineering credentials of staff in specialized R&D firms.

This diversity means that any generalizations about the nature of services and innovation in services must be qualified by numerous exceptions. Some services are more like manufacturing in terms of some parameters—some are technologyintensive (e.g. media, telecommunications), some work with material artifacts (e.g. rapid prototyping, repairs). And the operations of many manufacturing firms include a great many "services" activities (e.g. transport and logistics, office work, marketing and aftersales). Nevertheless, a set of common features characterizes many services and differentiates them from manufacturing.

For example: many services products are intangible ones, which makes it harder to store, transport, and export them than is true of manufacturing products. Historically, many service innovations have been difficult to protect via patent mechanisms, although this situation has begun to change in some sectors such as computer software and services, or FIRE (See Hall 2003; Graham and Mowery 2003, FhG. 151 2003). Services are typically interactive, involving high levels of contact between service supplier and client in the design, production, delivery, consumption, and other phases of service activity. Service products are often produced and consumed in the course of supplier–client interaction at a particular time and place ("coterminality"). Innovations may focus on this interaction as much as on conventional product and process characteristics, and may rely less on technical knowledge and more on social and cultural nous. Many services are highly information-intensive, with a preponderance of office-based work or
p. 436 communicative and transactional ↳ operations, such as telemarketing. Some service products are deliverable electronically, such as text-based reports, TV programs, music recordings, computer software, and websites. The informational components of many other services are subject to IT-based innovation. But

in other respects, the contrasts within the service sector are as significant as those differentiating the sector from manufacturing. After all, the sector includes the most concentrated, knowledge-intensive, and IT-intensive sectors in modern industrial economies (banking, professional services, etc.), as well as the least (retail, cleaning, etc.).

16.2.2 Research on Innovation in Services

Despite the economic importance of the sector, innovation in services received little systematic attention until the 1980s, when a trickle of studies appeared that focused primarily on services and new IT. In the 1990s, a number of major research projects on services innovation were launched, and some services were included in R&D and innovation surveys by the end of the twentieth century.

Although many recent surveys reveal growth in R&D investment within services, R&D surveys may underrepresent the innovative activities of service firms. The increases in service-sector R&D revealed by many of these surveys may reflect (*a*) increased coverage of services firms by surveys (services were excluded from many national R&D surveys until the 1990s), and (*b*) reclassification of some large firms' activities into the services sector. The US National Science Foundation's summary of recent trends in service-sector R&D investment, trends that incorporate both of the effects noted above, nevertheless suggests some systematic change in service-sector R&D activities, as well as important differences among the Triad economies in service-sector R&D:

> R&D performance by the U.S. service-sector industries underwent explosive growth between 1987 and 1991, driven primarily by computer software firms and firms performing R&D on a contract basis. In 1987, service-sector industries performed less than 9 per cent of all R&D performed by industry in the United States. During the next several years, R&D performed in the service sector raced ahead of that performed by U.S. manufacturing industries, and by 1989, the service sector performed nearly 19 per cent of total U.S. industrial R&D, more than double the share held just two years earlier. By 1991, service-sector R&D had grown to represent nearly one-fourth of all U.S. industrial R&D. Since then, R&D performance in U.S. manufacturing industries increased and began growing faster than in the burgeoning service sector... Unlike the United States, Japan has yet to see a dramatic growth in service-sector R&D... R&D in Japan's service-sector industries reached 4.2 per cent of the total R&D performed by Japanese industry in 1996 and 4.5 per cent in 1997 ...
>
> R&D within the EU's service sector has doubled since the mid-1980s, accounting for about 11 per cent of total industrial R&D by 1997. Large increases in service-sector R&D are apparent in many EU countries, but especially in the United Kingdom (19.6 per cent of its industrial ↳ R&D in 1997), Italy (15.3 percent), and France (10.0 percent). (National Science Foundation 2002: ch. 6)

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This picture of service-sector R&D investment undermines the view that innovation in services results solely from the sector's adoption of manufacturing innovations.[1] Abundant case-study evidence also highlights innovation by services firms (see e.g. Andersen et al. 2000; Tidd and Hull 2003). Indeed, some service industries invest heavily in R&D and pursue R&D programs that are at least as sustained as are those of manufacturing. Some useful information on corporate R&D can be gleaned from company annual reports and accounts, and Company Reporting Ltd. produces an annual analysis of these data for the UK's Department of Trade and Industry (DTI). The 2003 analysis (DTI 2003) reports that IT services rank fifth among all industries in worldwide R&D spending in 2003, and sixth among UK industries in 2003 R&D spending. The analysis in this report of R&D spending by IT firms indicates that Microsoft ranks eleventh in worldwide tabulations of corporate R&D spending, British Telecom is the fifth largest R&D spender in the UK, and Reuters the eleventh. Fully 6 per cent of the total R&D spending by the world's largest R&D

investors—the top 700 companies, whose R&D spending exceeded £35 million in 2002—is accounted for by firms classified as mainly involved in software and IT services. (The equivalent figure for the UK alone is 5 per cent.)

Data from the Community Innovation Survey (CIS) also indicate that services firms are major innovators, and that it is not just "high-tech" services (like software and telecommunications) which play significant roles in technology development. Although there are innovative activities in all branches of services, the innovation surveys depict lower levels of innovation and R&D investment within services, on average, than within manufacturing. The adoption by services firms of technologies produced in other sectors is indeed a major form of innovation in the sector, much of which thus displays "supplier-driven" characteristics.

16.2.3 Services Attributes and Innovation Trajectories: Industrialization and Modularization

Such patterns of innovation may be related to the ways in which (most) services differ from (most) manufacturing firms. How might the distinctive characteristics of service-sector firms produce distinctive patterns of innovation? Services' interactivity means that their products are often customized to particular client needs. Historically this characteristic has entailed the provision of services on a small-scale and local basis. Over thirty years ago Theodore Levitt (1972) argued that service firms needed to adopt a "production line approach," emulating industrial practices and moving toward mass production of standardized
p. 438 products, a more refined ↳ division of labor and higher levels of technology. In fact many services have been highly standardized and technology-intensive for a long time—consider railways and conventional telecommunication and broadcast services.[2] But it is apparent that the growth of large-scale firms in other service sectors is associated with a form of increased standardization. McDonald's and other fast food restaurants are one familiar example of such firms in the service sector. Fast food chains also display a measure of customization, in that their products are composed of various components, or modules, which can be combined in numerous ways according to customer demand; new modules may be added to increase variety and support other forms of innovation.

The industrialization of services has been criticized as generating low-quality, low-skill jobs (McDonaldization, or McJobs, to some commentators). Other types of innovation and reorganization in services may produce new forms of social exclusion. For example, the use of call centers and other elements of banking automation often occurs in tandem with the closure of traditional outlets, such as high street branches. Out-of-town hypermarkets have had an adverse effect on high street shopping areas and their environs. Fears have been expressed that consumer e-commerce will have similar effects, since these new channels of customer contact may not be available to all consumers. Such concerns may trigger consumer, regulatory or legislative responses that will affect service markets and innovation strategies.

But exactly what is connoted by the "industrialization" of services cited by Levitt? After all, many manufacturing firms now emphasize flexible specialization, mass customization, reintegration of highly atomized division of labor, and the like. Some of these trends are making manufacturing more like services and some are being emulated by large services companies, even as other service organizations continue to follow more classical industrialization trajectories.

One way in which services have emulated manufacturing is in the adoption and development of an organizational innovation—quality control procedures. In service firms, as has been true of many manufacturing firms, attention to quality has often served as a trigger to innovation, by requiring firms to view their services as consisting of a number of component parts to which quality control principles can be applied. This is typically used to identify areas where there is weakness in service performance and where change thus needs to be engineered. Information Technology is often introduced in the context of

improving customer service quality, especially in speeding responsiveness via means such as call centers. Understanding the components of a service also often generates insights into ways in which these components can be transformed or reconfigured into new service bundles (Sundbo 1998). Modularization underpins much services innovation, since decomposition of service processes and/or products may spur process innovation and the identification of new products and product combinations. This type of
p. 439 innovative activity does not necessarily rely on R&D investment,[3] though in the sectors where there has ↳ been much talk of "unbundling"—software and telecommunications—there is much conventional R&D.

Another major impetus to "services industrialization" has been the application of IT. This has made it possible to automate elements of the back-office work of many service firms and large firms in other sectors—for instance through the use of document processing, email, Enterprise Resource Planning software and systems, etc. IT is widely applied in back-office work, and in the management and execution of customer-facing services such as mail and telephony. Many of these IT applications make possible the provision of customized services through recombinations of standard service modules. Back-office automation through IT also has changed the spatial location of service activities. Telephone call centers—dedicated offices where the work revolves around the computer-assisted answering of telephone calls, normally for the provision of routine customer service information—are a case in point.[4] Over the last decade we have seen the relocation of call centers in the UK to lower-wage areas of the country, and more recently to the Indian subcontinent—a specific manifestation of the process of "offshoring." There is considerable debate as to the extent to which higher-level office service work will also be subject to offshoring—some quite sophisticated software activities have followed more basic programming work in the move to overseas locations. The new international division of labor clearly involves a redistribution of service as well as manufacturing and extractive activities.[5]

16.2.4 Services Diversity and IT-related Innovation Trajectories

IT has been very widely applied across service sectors—indeed there is disproportionately more investment in IT from services than from manufacturing (which has given rise to some discussion of the "productivity paradox" as a services phenomenon).[6] In some cases, these applications involve little more than adopting mobile telephones, personal computers, and similar devices and their supporting software and services. In many cases, however, IT applications require significant innovative effort, as substantially new applications of the IT are developed. Large service users in sectors like finance and retail have invested huge sums in developing sophisticated networks and new systems for capturing, archiving and analyzing data. Large numbers of graduates in IT-related subjects have been absorbed by these sectors, to the extent that sometimes there have been complaints from manufacturers that a skill shortage has been created.[7]

In many ways IT has provided a technology that can be applied to the generic information-processing activities of services, much as earlier revolutionary innovations in energy technology (e.g. the steam engine,
p. 440 or electric power) could be ↳ applied to generic materials-processing activities in manufacturing. IT is by no means the only technology employed in services, nor the only technological field in which services firms are active innovators. Medical services and specialized biotechnology service firms are major users of genomics and post-genomics knowledge and techniques, for example. But IT is pervasive across services, and the uptake of new IT stimulated a recognition that services were often users of innovation and indeed innovators in their own right. Richard Barras (1986, 1990) noted that in many ways the IT revolution was an industrial revolution in the service sectors. He argued that IT-based services innovation has followed a pattern that differs from that usually depicted for manufacturing. In contrast to the classic product cycle in manufacturing, he suggested that services innovation—or more precisely, their IT-based innovation—typically follows a "Reverse Product Cycle" (RPC).

Barras argued that the RPC involved three phases—Improved Efficiency, Improved Quality, and New Services. IT was first introduced to improve existing processes, and only later became the basis for service product innovation, reversing the "product cycle" model of manufacturing innovation popularized by Abernathy and Utterback (1978).[8] For "vanguard services" (the technologically sophisticated sectors such as financial services, for instance), Barras suggested that these three phases roughly characterized the 1970s, 1980s, and 1990s respectively. Thus, insurance services moved from computerization of policy records, to providing online policy quotations, and then to supplying complete online services during these three decades. A similar account applies as well to service functions outside of the service sector. Many new telematics service firms—such as EDS, which emerged from General Motors—were organized around manufacturing firms' in-house innovations in communications and data management processes that enabled these firms to streamline their internal communication activities. Eventually, these service activities were spun off as IT service companies. Some online information services originated from in-house data management services, e.g. for publishing firms.

The analysis of Barras has influenced a large body of scholarship that highlights the contrasts between services innovation trajectories and those of manufacturing (Barras 1986, 1990). Many services may remain non-innovative, but increasing numbers of IT adopters are experimenting with applications and related innovations, thereby providing new arenas for testing the implications of the Barras framework.[9]

Critics of the RPC model have highlighted a number of issues:

- counterexamples (e.g. in IT-based services, which often begin with product innovations);
- conceptual difficulties (the blurring of production and consumption makes it difficult to establish a point in time at which innovation shifts from efficiency enhancement to product innovation);

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- ↳ the historically specific nature of the story (after assimilating new IT and going through an RPC process, will services then follow the classic product cycle?).

Uchupalanan (1998, 2000) mounted a systematic critique of the RPC approach, tracing the history of five IT innovations[10] through all firms in the banking services sector in Thailand. He uncovered a diverse range of innovation strategies and trajectories that were far richer than the RPC account. The banks were influenced by the strategies of competitors with respect to each given innovation, by their experiences with earlier innovations (and their plans for others), and by pressures from regulators and the market. The interrelation of market competition, firm circumstances and innovation dynamics meant that the RPC "story" of innovation processes was rarely applicable in this context. At best it was one of a number of possible patterns of development.

The RPC approach, which has proven influential in many recent analyses of services innovation, may neglect non-IT innovations and innovations undertaken in earlier periods of service innovation. But this framework's attention to the increasing innovative activities of service firms, as well as the historic omission of their innovative activities from most scholarship, means that the RPC is an important contribution, providing a starting point for further research on services innovation.

Other studies of services innovation place more emphasis on the relation between service firms and their clients. One line of work uses the term "servuction" (services production, intended to highlight analogies with manufacturing production activities) to describe the activities and procedures involved in producing and sustaining supplier–client relations and delivering "service"—roughly what we call "interactivity" above. Belleflame et al. (1986) classified a sample of innovations from service companies in terms of whether these centered on servuction, production, or a combination of both (without assuming that these would necessarily be IT-centered innovations),[11] and found numerous examples of all types of innovation. Tordoir (1996) studied professional services, and noted very different patterns of interaction between

suppliers and clients, introducing a distinction between "jobbing" relations (where the service supplier provides a relatively standardized service), and "sparring" ones (where the supplier and client negotiate the details of what service is to be provided, and how). More recent studies have addressed the question of how service innovation differs according to the degree to which services are standardized or specialized to specific clients (cf. Hipp et al. 2000, 2003). The more interactive services would seem to require greater exchange of knowledge between service firm and client, and the learning processes involved can be a fertile basis for innovation: however, many of the innovations are liable to be one-off solutions for particular problems, or elaborate customizations of more generic solutions.

The RPC approach argues that IT-based innovation begins with back-office processes and then moves
p. 442 forward into functions involving more customer contact. ↳ These latter functions may involve new service products (such as new types of bank accounts more closely tailored to the circumstances of individual clients), or delivery innovations (e.g. online banking and cash machines). There is also scope for innovation in other customer-facing functions, for example in targeted marketing and in computer-assisted helplines, etc. Interaction around service relations certainly does involve information flows—especially in the case of informational services like counseling, consultancy, and education. But interaction may involve many physical elements, not all of which are primarily carriers of informational content (consider services performing physical and biological functions like catering, transport, cleaning, surgery, and hairdressing).

IT-based innovation may apply to the informational elements of such service provision—marketing, ordering, transactions, etc. IT may be an important adjunct to other types of services innovation—without telephones, pizza delivery services would be much less attractive! But it is not the only vector. Other types of interaction are also involved in services, including physical and other elements, and these may benefit from non-IT-based innovation—motorcycles and insulated boxes in the case of pizza delivery. The RPC model, which emphasizes the catalytic effect on services innovation of the introduction of IT equipment and software from manufacturing sectors, could be extended to apply to these technologies in the service sector as well. Examples include supermarkets investing in the development of refrigeration technology (as well as general refrigeration design inputs, supermarkets played important roles in determining what sort of shift was made to alternatives to CFCs in equipment), railway companies supporting the development of better trains (before privatization, British Rail had a substantial R&D facility conducting work on topics such as faster engines, more environmentally sound carriage painting practices, and safety issues), and so on.

Another approach to examining the way in which services differ considers the key transformations that they effect, and distinguishes among three broad groups of services (Miles 1993). This classification highlights the adoption and innovation dynamics of services with respect to a number of major technologies in addition to IT.

A first set of services, *Physical Services* (transport, domestic services, catering etc.) involve physical transformations. These have been particularly suitable for the application of automotive and electric power technologies—e.g. in freight haulage, laundries, cooking equipment, and so on. The adoption of new technologies in this sector has frequently created competition among different modes of provision: between road, rail, and air services; laundries and launderettes; traditional restaurants and fast food outlets; etc. But the competition between modes of provision can go much deeper. In particular, consumer services such as laundry or food preparation have been subject to competition from what Gershuny (1978) described as
p. 443 "self-services," production by consumers in the household. Such technologies as the ↳ automobile, home refrigeration and other household appliances have enabled consumers to use manufactured goods to provide services in the household in competition with service firms. The adoption by consumers of these manufactured goods also has given rise to some new services, such as automotive repair establishments.

New IT is now widely used in physical services, such as transport, logistics, retailing, and warehousing. Computers have long been applied to their back-office accounting and transactional functions, and

electronic cash registers and scanners[12] introduced into supermarkets and smaller shops. These IT-based devices are linked to the office systems being used for stocktaking, and in some cases data are fed to automated warehouses and much wider systems of supermarket automation. New "transport informatics" systems do more than just document timetables and the locations of vehicles, providing advanced routing and tariffing procedures, backed up by mobile communications, "smart cards" and other innovations.

The large-scale *Human Services* subsector has often been organized under the auspices of the welfare state, and many of the front-office tasks in this subsector have had little scope for application of generic IT. Many of the *Social Welfare* activities of this subsector have utilized office and communications systems, while the *medical* field has exploited successive generations of medical technology—surgical equipment, pharmaceuticals, radiology, etc. Typically both sets of services have had to combine large-scale administrative data processing applications (payroll, pensions, passports, driving licenses, and the like) and planning (for example, managing housing systems and waste disposal services, monitoring epidemiological and environmental statistics) functions, with tasks that are much more customized in terms of the characteristics of specific citizens or clients. The large-scale tasks were early pioneers of computer use. Now, PCs and data networks are being widely adopted, allowing decision support in the context of the details of individual clients—for example, expert systems to aid medical diagnosis and prescription, or to speed up the task of assessing individual entitlement to welfare benefits. There are some self-service-type applications, too, where the clients use public access terminals or home-based equipment to gather information on service provision, or access the services directly (e.g. interactive teaching aids, databases on available jobs or benefits, etc.) Some integration within and across public services is possible as information on the same client held in different databases can be combined—but privacy rules have often impeded such integration, and there are many other instances where perceived threats to privacy and civil liberties have restricted innovations involving capture and distribution of information.

Finally, *Information Services* are relatively less dependent on motor power technologies, although electricity is important to them. They have made considerable use of information technologies, including those that predate new IT and its foundations in microelectronics. Some of these services, such as broadcasting and
p. 444 cinema, are founded on these technologies, while others, like consultancies and ↳ technical services, have used them as important tools for producing and delivering their outputs. In some of the consumer services here, new and even older generations of IT display self-service trends similar to those that motors induced in physical services. Thus, in the field of entertainment, traditional consumer services like theater and cinema have been subject to competition from new ones such as TV and other audiovisual equipment and, more recently, videogames, PCs, and online entertainment. Professional and business services are among the most IT-intensive sectors of industry, as are financial services, which are also largely concerned with information processing (in this case processing and manipulating data about property relationships).

New IT is thus enormously important—and often very visible—in information services. Such innovations as automated teller machines and smart cards, new telephone and telematics services, and shifts from analog broadcasting to interactive digital media and "narrowcasting", are all the focus of considerable investment and activity. Most national broadcasting services in the West now offer opportunities to access archived radio and sometimes TV services through the Internet, and often provide a good deal of additional content, discussion fora, and the like.[13] Some of the service firms involved play a prominent role in guiding the innovations, as in the case of banks who are heavily involved in defining the characteristics of new teller machines. The pace of innovation in these industries is quickened by the shift in regulatory policy in many countries, which has led to new entrants and increased international competition confronting many firms and sectors (Sauvé and Mattoo 2003).

This sort of analysis provides a useful mapping of different types of services and innovation trajectories, but reveals little about the dynamics and processes of innovation in the various services that have been distinguished. The RPC model is not the last word on this subject. One potentially fruitful avenue for further

research applies evolutionary and characteristics-based approaches to services innovation (see Gallouj 2002).

16.3 Innovation Systems and the Organization of Innovation

IT provides a generic technology that can bewidely applied across service sectors—a substantial break with past experience, where even technologies like automobiles and typewriters, almost universally adopted in
p. 445 certain services branches, were rarely ↳ applied in others.[14] Though services vary in the extent and speed with which they are adopting these innovations, and some of them are more relevant to certain branches of services than to others, many technological opportunities are opening up for all services. Even personal services such as hairdressing are subject to innovations—there are shops where video technology and PCs are used to give clients an impression of how they would look with different hairstyles, for instance. And IT is a very configurational technology, which challenges users to develop new software and interfaces, and to bring diverse elements of technologies together in new ways.

Their increased technology-intensity has not yet transformed all of the features of innovation in services. Many services are arguably laboring under a heritage derived from past periods where few generic technologies found ready application in their activities. The lowtechnology-intensity that previously characterized services meant that many services firms paid little attention to strategies for the management or adoption of innovation. Limited use of advanced technology would also mean that most service firms would have little incentive to be linked into innovation systems that would connect them with those responsible for generating the new technologies. And in the wider innovation systems themselves, few of the innovation-related facilities offered by institutions such as university departments, research institutes, and government laboratories are tailored to the requirements of services. It is thus not surprising that few service firms make much use of these resources currently (Institute of Innovation Research 2003).

There are, as always when discussing services, exceptions. For example rail, broadcasting, and telecommunications services, many of which were state-owned and very large organizations for much of their existence, were closely related to manufacturers. These large services firms frequently ran their own laboratories, testing sites, technical training programs, etc. Other exceptions include very largescale service firms in sectors like financial and retailing services. Especially in the latter case, supermarket chains have become adept managers of their own supply chains, and are often active in dictating production processes and products—including innovations—in their agricultural and manufacturing suppliers. For example, their suppliers may be requested to adopt specific environmental or animal husbandry practices, to use ecommerce techniques, etc. As well as influencing their suppliers, such firms have been pioneers in some sorts of technology for their own use—for example, data warehousing and data-mining methods.[15] Another, and particularly important, class of exceptions, are the business services that are, as we shall see, important actors in innovation systems, contributing to innovation across the economy. Consultancies, training organizations, and many firms helping to service new technologies are just a few of the agents involved here—not to mention specialized R&D and design services themselves!

But relatively few service firms and sectors have strong links with national or regional innovation systems. The organization of innovation is a new development in many service firms—for instance, in a set of recent
p. 446 interviews the author found ↳ that many large service firms in the UK were only just beginning to examine the application of IPR arrangements to their innovations, as opposed to their trademarks and copyright content.[16] In part, this new orientation reflects a general emphasis on intangible assets, and in part it is in response to the emergence of "business methods" patenting in the USA, which are seen as impacting upon many service operations.

One result of this heritage is that many service firms are unable to apply relevant knowledge, and, more particularly, are unable to learn effectively. They can rapidly adopt "off the shelf " technologies like PCs, but find it harder to develop more customized or innovative solutions. In part this is because services innovation is rarely organized in terms of the "standard" models of R&D management structures, and is typically conducted on a more ad-hoc, project management basis. Service firms tend to stress human resources and technology acquisition rather than formal R&D (Tether et al. 2001; Sundbo 1998), resulting in limited coordination of learning experiences—the innovations that are made are often not reproduced in subsequent projects, and flows of knowledge within and between services firms as to technological opportunities, good practice in innovation, and the like, may be limited.[17] CIS data discussed below show that many services sectors display somewhat lower levels of innovation than their parallels in manufacturing. This may result from weak integration into innovation systems, the orientation of existing technology support institutions toward manufacturing activities, and weak internal organization for innovation in many services—even if the firms themselves do not report exceptional problems in innovative efforts.

Such features of services innovation partly reflect the historical legacy discussed above. But they also partly reflect the fact that the features of different types of economic activity can shape innovation processes and trajectories in distinctive ways. Arguably, the nature of service innovations demands different approaches to management and organization of the innovation process—for example, requiring more emphasis on the service workers (especially if professionals) and clients, and on the interaction process between them. The traditional R&D lab may not be well suited to such innovations, though we find large technology-intensive services firms have been running such laboratories (in some cases, such as telecommunications and railways, for many decades).

The differences between services and manufacturing innovation may reflect historical legacies stemming from the low technology-intensity of many services activities (which may be overcome in time), alongside of the significance of characteristics such as interactivity to many services (which may demand specific processes and practices). But these generalizations need to be qualified to take into account the enormous heterogeneity within services—they do not apply to large segments of the services sector. Developing a more nuanced framework that is sensitive to the enormous heterogeneity among the various components of the services sector is an important task for future research.

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16.3.1 Innovation Surveys and Services

Despite substantial efforts to improve the situation in recent years, data on many aspects of services and services innovation are less detailed and less comprehensive than those for manufacturing. Even the Community Innovation Survey excludes public and personal services. Many features of services innovation are quantified in such innovation surveys and similar data, but qualitative features are harder to detect. Few available innovation indicators were designed with services in mind, and thus may fail to adequately capture the dynamics of services innovation.

With these caveats in mind, as well as the discussion above on the differences between innovation in services and manufacturing, it is noteworthy that the evidence from these surveys indicates that services innovation does not seem to follow dramatically different paths from those displayed in manufacturing. The differences appear to be more of degree than of kind.

Tether et al. (2001) present the most extensive analysis to date of services innovation, based on the CIS2 (second Community Innovation Survey) data.[18] Just under half of the service enterprises reported undertaking innovative activities between 1994 and 1996. This share is slightly smaller than that reported for manufacturers, and this difference between manufacturing and service firms' innovation propensities

remains even when size is controlled for. Most service branches include a higher share of smaller businesses than do manufacturing branches (though financial services are dominated by very large firms). And larger enterprises are more likely to engage in innovative activities in (most) service branches, as elsewhere. But this is not enough to account for the difference between services and manufacturing firms in reported levels of innovation. (Looking at the size distributions, we find 36 per cent of small services and 48 per cent of small manufacturers; 48 per cent and 55 per cent of medium-sized services and manufacturers, respectively; and 73 per cent and 79 per cent of large services and manufacturers, respectively, are classified as innovative enterprises.)

The proportion of innovators is high amongst the technology-oriented services, many of whom are comparable in terms of reported innovation levels to high-tech manufacturing—68 per cent of computer services, 64 per cent of telecommunication, and 55 per cent of technical services are classified as "innovative enterprises" in CIS2. More traditional services appear to be particularly low innovators (only 24 per cent of transport services, for example)[19].

Such results should be interpreted cautiously, since as this chapter has pointed out, the measures of innovation employed in the CIS are probably less than ideal for studying services. Services firms are less likely to see what they are doing as technological innovation, rather than customization or one-off service production. Organizational innovation may be important in services, but is not examined in the survey. The CIS2 also fails to specify the sorts of technology involved in innovations, meaning that the role of IT in
p. 448 services innovation cannot be traced. ↳ But the role of IT in services innovation is difficult to overstate—Licht and Moch (1999) found that *all* innovating services firms in Germany undertook IT innovations, even if they also applied other technologies. Unfortunately, the survey they worked with only covered services, so we cannot say whether this conclusion would also apply to other sectors.

Contrary to some expectations, just under half the innovating service enterprises covered by the survey analyzed in Licht and Moch reported that they had engaged in R&D between 1994 and 1996. Indeed, a quarter of these firms reported having engaged in R&D on a continuous basis. However, R&D is less commonin innovating services firms than amongst manufacturers of similar characteristics, again controlling for size.[20] R&D is more common in large service enterprises, and in technologyoriented services.

Of course, R&D is not strictly speaking the most common or most important source of innovation for many services. Acquisition of machinery and equipment, acquisition of other external technologies (including software) and training directly linked to innovation were the most widely undertaken innovation-related activities in services, according to CIS2 data (Tether et al. 2001). These sources illustrate the importance of technology adoption in services innovation. The importance of the human element for services is also underlined by the training expenditures of these firms. On average, acquired technologies accounted for the largest share of expenditures on innovation; while in-house R&D accounted for another quarter of total expenditures on innovation, with this share higher amongst technology-oriented services. Technology-oriented services tend to spend most on innovation, but all sectors surveyed contain some very high spending (and some very low spending) enterprises.

Another set of CIS questions concerned sources of information for innovation. Tether and Swann (2003) contrast services and manufacturing firms' use of information sources, using CIS3 data for the UK. The broad pattern of results is fairly similar across the sectors, with rather more manufacturing firms typically reporting use of each information source. Sources within the enterprises were the most commonly used, being cited by 85 per cent of manufacturers and 81 per cent of services. A substantial proportion of non-R&D performing innovators reported using such sources. Suppliers are also widely used by both sectors (83 per cent and 77 per cent of manufacturers and services firms respectively cited these sources), followed by customers (80 per cent and 73 per cent). Rather less important sources of information are the technical press (65 per cent for both sectors), competitors (66 per cent and 62 per cent), and trade fairs (72 per cent

and 58 per cent). Two information sources where services firms report making more use than manufacturers are meetings and conferences (manufacturing 52 per cent, services 62 per cent), and consultants (48 and 56 per cent). Other sources, such as standards, government offices, other parts of the enterprise, and universities (36 and 24 per cent) are more often cited by manufacturers.

p. 449 The sectoral differences are less acute than might have been expected (and closer inspection of variations across different services indicates considerable diversity here). But the greater use of consultants and lower use of sources such as Universities tends to confirm the notion that many services are poorly linked into wider innovation systems, and the formal institutions that support them.[21]

Many specialized services firms are carrying out functions that are also undertaken within firms in other sectors of the economy. Office work, transport, commercial transactions, security, and catering, and similar activities—services—are undertaken in all sectors, though to differing degrees. Just as innovation surveys were not designed with services in mind at the outset, so there may be some overlooking of service functions, which may well slip between the "product innovation/process innovation" categories of CIS-type instruments, and may even be matters that the respondents to the surveys are unaware of. A number of recent studies consider services supplied in support of the core products of manufacturing firms (e.g. Kuusisto 2000; Lay 2002; Mathé and Shapiro 1993); commentators such as Davies (2003) and Howells (2001) have argued that the service component of such products is growing dramatically in many sectors. The issues that confront adoption and innovation of service-related technologies in services firms may well be liable to affect innovation in service functions in manufacturing firms. Service functions can in principle be significant loci of organizational learning and innovation in all sectors. It remains to be established whether the organization of innovation in such service functions more resembles conventional manufacturing innovation, or more informal systems used for services innovation.

16.3.2 Innovation-Supporting Services in Innovation Systems

Business services have risen dramatically in economic significance—for instance, from little over 3 per cent of US value-added and employment in 1970 to 9.9 and 13.8 per cent respectively in 2000, with equally striking increases in other countries (ECORYS-NEI 2003). They have also become highly evident contributors to innovation across the economy.[22] They provide intermediate inputs to industry and other organizations—they are business services as much because they are servicing business processes as because their clients are often private firms themselves. Knowledgeintensive business services (KIBS), in particular, play important roles in innovation systems (Leiponen 2001; Miles 1999*b*; and several chapters of Gadrey and Gallouj 2002). Some are transnational firms, dealing with knowledge from the frontier of practice. But many are smaller; locally based KIBS may be important agents of transfer of locally-specific knowledge, embedded in local networks, between actors in regional innovation systems (cf. Kautonen 2001). Several
p. 450 studies suggest that the ↳ presence and use of KIBS enhances the performance of economic sectors and regions.[23]

KIBS include all kinds of business services that are founded upon highly specialized knowledge—social and institutional knowledge in many of the traditional professional services, or more technological and technical knowledge. These firms typically have very high levels of qualified staff, such as university graduates.[24] Some KIBS are based on administrative, legal, marketing, or similar knowledge. Others are directly based on scientific and technological knowledge—testing, prototyping, environmental services, engineering consultancy, etc. The knowledge requirements for technology users are bound to be more challenging where new technology is involved. Firms are less likely to have acquired the knowledge necessary to understand, master, and utilize new product and process opportunities.[25] Thus, many technical KIBS focus on new technological opportunities—examples include Web and Internet, software and

computer services; others on the production and transfer of knowledge about new technology: information and training services, for example.

Technology-related KIBS sectors are among the most active innovators in the economy, as indicated by CIS and other data (e.g. DTI 2003, which includes data indicating the high levels of R&D expenditure, patenting, etc. of software and IT services).[26] We saw above that Tether and Swann (2003), using CIS3 data for the UK, found that most services are poorly linked with the public elements of innovation systems (e.g. in terms of sourcing information from and collaborating with universities). But they also report that some technical KIBS were outstandingly well linked to these components of innovation systems. Some technical services (e.g. contract R&D) had uniquely high levels of interaction with the public science base, higher than any manufacturing sector; however, IT services and more professional services tended to have low levels of contact, relying more on professional associations and the like to refresh their knowledge.

Many KIBS play important roles in innovation processes in their client firms and sectors. These roles may not be altogether new—some have existed for many decades. But there has been considerable growth of employment and output in KIBS sectors, which can only mean that their use has also expanded, and suggests that their significance for innovation across the economy will also have mushroomed.

What are these roles? KIBS may provide the firm with general information about its internal operations and external environments. Technology and innovationrelated information often forms part of this. KIBS may simply play a role in identifying the nature of a particular problem or class of problems confronting the firm (for instance, that competitors are launching products with new functionalities, that regulations may mean that processes will have to generate less of a particular pollutant, etc.). KIBS may propose ways of solving a
p. 451 technological problem (for example recommending that particular strategies are undertaken for ↳ product or process innovation). They may provide advice (for example, recommending a specific technological solution), or actually implement such a solution on a "turnkey" or long-term basis (as in the case of systems integrators and facilities managers). The KIBS relate technological knowledge to the specific problems encountered by the client. German survey data indicate that technology-related KIBS are more likely to produce specialized products that are tailored to client needs than were the other services studied (Hipp et al. 2003).

In addition to expertise in specific industrial, technological, or functional domains, KIBS professionals require skills in interpersonal communication, presentation of materials, "impression management," and the like. These are fairly rare capabilities, and their combination is rarer still: for this reason labor costs and wages are high in most KIBS. Toivonen (2001) finds that in Finland effectively all of the KIBS studied require combinations of generic and sector-specific skills. Common requirements were marketing and sales skills; social skills such as sensitivity to others, willingness to share knowledge and motivate others, capacity for self-renewal, IT-related skills, and sector-specific knowledge related to one's particular expertise, to the processes and business mechanisms characteristic of the KIBS, and knowledge about the industries and organizations of clients.

16.4 Conclusions

The growth of services to their dominant position in industrial economies means that we can no longer ignore services innovation, or simply assume that it follows the patterns and processes depicted in manufacturing production processes. Understanding "service innovation" may widen our approaches to explaining, measuring, and managing innovation. Innovation studies will have to take on board the issues of organizational and market innovation, interorganizational and client-facing innovation, and even aesthetic and cultural innovation. Many of the mostly widely remarked features of the evolution of technological innovation in the late twentieth century depended centrally on combined material and non-material innovation. This suggests that our models of innovation should put less emphasis on artifacts and technological innovation, and more on seeing innovation as involving changes in market relationships that can be effected at least partly through artifact and service innovations, with organizational and technological dimensions.

Service innovation now occupies a more prominent position in innovation studies over the last few years, but this has yet to be reflected in an accumulation of knowledge about services in innovation policy. There
p. 452 are few obvious efforts to ↳ give services a prominent role in such policies, and their specific requirements may be overlooked in current programs. (There is a dearth of research concerning how innovation policies affect services, let alone analysis of service-related policies.) One exception is Finland, where KIBS are being treated as important actors in the innovation process. We have seen that KIBS are significant elements of innovation systems, and as policy adopts a more systemic viewpoint, we can expect their role to become more of a focus in policy.

The greater policy salience of services innovation is, in turn, likely to stimulate more detailed research into the area. It will be important to move beyond documenting the growth of KIBS, to examine precisely how they function as knowledge sources and intermediaries: what sorts of exchange of knowledge take place in what ways and at what steps of the innovation process; how these are managed on service and client sides of the equation; what skills and capabilities are required for effective and innovative solutions to be implemented. There are still very few studies that address these fundamental questions.[27]

Notes

1. This view has been widely expressed, for instance, with services being classified as supplier-driven in Pavitt's original taxonomy of types of innovation (1984)—though in a subsequent paper (1994) he put software services into the "specialized supplier" group, and added a category of "information intensive" firms which included finance, retailing, travel and publishing.

2. Hipp et al. (2000) show that a surprisingly large proportion of German service firms consider their outputs to be largely standardized. Least standardization was reported by business services such as technical and computer services.

3. For just one example, consider Jones (1995) on in-flight catering services.

4. By2000, about 1 per cent of the UK workforce was employed at telephone call centers.

5. For a series of studies on service internationalization and innovation—still a largely unexplored topic—see Miozzo and Miles (2003).

6. Cf. Miles and Matthews (1992), Roach (1988) for early analyses. The data, derived from input–output tables, allow us to examine investment patterns across different industries. IT investment from services sectors constitutes a greater share of this investment than services' output constitutes of all output. And for the UK in the 1980s, Miles and Matthews found that the proportion of sectoral investment devoted to computers and telecommunications equipment was 5.7 and 4.6 per cent respectively for services, 4.1 and 4.0 per cent for manufacturing. (The expenditure on telecommunications equipment

among services at this time was heavily dominated by telecommunication services firms; and in general the high levels of IT investment are driven by specific sectors, such as finance.)

7. Not that the problem is not reported by manufacturers—I found UK public sector organizations in the 1980s to be vociferously complaining that their projects were plagued by departure of IT staff to financial services. Beyond the affluent West similar concerns are ↳ also raised, for instance *Computer world Singapore* (7(3): 20) documented in October 2000 that financial services computer professionals there were consistently paid more than comparable staff in other sectors.

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8. This model, while proving extremely influential and a useful starting point for analysis, is widely viewed as of limited applicability even to manufacturing.

9. US researchers have also suggested such developments: see e.g. Faulhaber, Noam, and Tasley (1986). But see Bronwyn Hall's Ch. 17 in this volume, which indicates that "followers" may spend a long time in that state before becoming innovative in their own right.

10. Interbranch on-line services; automated teller machines; credit cards and associated services; remote banking, and electronic funds transfer at point of sale.

11. Gallouj and Weinstein (1997) provide a useful review, comparing "servuction" to a number of other formulations. Though there have been few "servuction" studies focusing on innovation, the conceptual approach continues to be developed, e.g. by Gadrey and de Bandt (1994).

12. Note that bar-code scanners require the cooperation of manufacturers in bar-coding their products. Similarly, financial service innovations like credit and debit cards require the cooperation of retailers in accepting these cards and using validation systems.

13. The BBC website at http://www.bbc.co.uk is a case in point. New BBC radio and TV channels are only available digitally, and remarkable volumes of archived content and text are also online.

14. Probably the only universal innovations were ones involving the construction and maintenance of buildings and technologies of heating and lighting—and telephones. Such innovations typically involved relatively little user learning. Even where new skills were required (e.g. automobile driving skills—which in any case were typically acquired for everyday purposes) these technologies required relatively little configuration to meet the needs of specific users. Indeed, limited scope for configuration was presented, and the relevant engineering services (e.g. garages) were a matter of high-street crafts rather than industrial laboratories.

15. NIST in the USA (TASC 1998) examined how technology-intensive services in several sectors deal with technology barriers. Some barriers were technology-specific—thus the high risks of complex technology led to needs for technical expertise not available to most individual firms. Collaborative R&D was undertaken with other firms in their industry (and often with manufacturing sector partners, too), typically to gain access to complementary research or technical skills. IT development barriers were overcome by codevelopment projects with manufacturing suppliers. Such collaborations were not in general oriented to knowledge resulting from basic research. IT implementation barriers were associated with high costs of configuring and employing systems (often IT implementation cost four to five times more than acquiring the hardware and software). Other barriers were "market-related"—thus high transaction costs associated with the systemic nature of new IT, which led to emphasis on standards-related activities to reduce barriers to IT development and implementation. Standards and protocols were often central to innovation strategies.

16. See the report by FhG-ISI (2003), which deals especially with services' patenting activities. The general argument is that the patent mechanism is not very appropriate to many service innovations, and thus the firms are not particularly oriented to these types of ↳ intellectual property. Nevertheless, the study found numerous service firms active in patenting activity and the development of new IP strategies.

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17. Again, there are striking exceptions to this rule—some service firms in areas like IT and consultancy are pioneers in innovation and knowledge management techniques.

18. The sectors studied excluded public and consumer services such as retail and HORECA; and microbusinesses and very small firms were also excluded.

19. Tether and Swann (2003) present detailed information on UK firms in CIS3 data, where different types of manufacturing

and service are contrasted in some detail.

20. Nearly 70 per cent of the innovating manufacturers conducted R&D.

21. Other evidence supporting this view is presented in Miles 1999*a*; Tether and Swann 2003.

22. One—but only one—of the sources of growth in business services, in particular, is the outsourcing of activities previously undertaken in-house by firms and organizations in other sectors.

23. Some authors even describe them as forming a "second knowledge infrastructure." The traditional primary knowledge infrastructure is mainly a matter of Higher Education Institutions (HEIs) and government laboratories/public research and technology organizations (RTOs).

24. It isdifficult to attribute causality to the correlational data involved here, but some very different types of study yield broadly similar results. Researchers like Antonelli (2000) and Tomlinson (2000)—using slightly different input–output datasets, and statistical methods—show an association between the use of KIBS as intermediate inputs, and the performance of the user sectors. Doubt is cast on the methodology by ECORYS-NEI (2003), however. Peneder (in European Commission 2000: ch. 4) found that clusters of industries characterized by high KIBS use performed particularly well. Hansen (1994) reported that the growth performance of the economies of US cities was related to the size of the KIBS sectors in these economies. An interesting study by Muller (2001) examines relations between KIBS and SMEs at regional level, suggesting benefits in terms of innovation on both sides.

25. Tether and Swann (2003) show that in the UK, at least, these are the sectors with the highest graduate-intensity. There are clear differences between those KIBS with high levels of science and engineering graduates (e.g. Technical and IT services) and those with other classes of University graduate (e.g. consultancy and marketing services).

26. CIS2 data show that acquisition of external technology through use of consultancy services is the second most frequent mechanism used by manufacturing firms. The most important mechanism is direct equipment purchases.

27. Tomlinson (1999) analyzed UK survey data, finding that KIBS staff are more likely than are others to learn new things, to receive training, to work with computers, and to move between different types of work. Labor mobility is often emphasized as a means for diffusing knowledge around the economy. Tomlinson argued that KIBS provide an alternative —perhaps a superior—means. (The survey suggests that people moving between jobs fare poorly on these indicators of "life long learning." Whether this result is peculiar to the UK and/or to the recession underway at the time of the study and the downward mobility it induced, requires further study, since the argument is very provocative.)

28. Cf. ECORYS-NEI (2003) for a review of literature on business services and their clients. Several relevant studies are presented in the recent collections by Dankbaar (2003) and Tidd and Hull (2003).

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