Patterns of innovation in service industries

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The diversity of service activities means that service innovations and innovation processes take various forms. In this paper, we use input/output and other data to depict how service industries vary in such areas as products, markets, work organization, and technological characteristics—most being very distinctive from primary industries (i.e., extractive industries such as agriculture, fisheries, forestry, mining, petroleum, quarrying, and the like) and secondary industries (i.e., manufacturing, construction, and utilities). Innovation survey data indicates that some service organizations behave very much like high-technology manufacturing. This is especially true of technology-based, knowledge-intensive business services (T-KIBS). Distinctive innovation patterns are displayed by KIBS based more on professional knowledge and by large network-based service firms, while many smaller service firms conform to a supplier-driven pattern. Only a small segment of service innovation conforms to the typical manufacturing-based model, in which innovation is largely organized and led by formal research and development (R&D) departments and production engineering. Project management and on-the-job innovation are common ways of organizing service innovation. Innovation policy and management have to be much more than R&D policy and R&D management: This is recognized by some national governments and in some business schools, but the full implications of a service-dominant logic are still rarely found.

INTRODUCTION

Discussions about service activities are often confused because the term *service* is used for many different things. Service *functions* are transformations of the state of artifacts, human beings, or data. They may be accomplished by service products, derived from goods (e.g., capital service), or created by consumers (self-service). They may be provided by any sector (e.g., after-sales service from manufacturers).

A service *product* is typically a service function or set of functions marketed as a commodity or public service. (Service products are rarely material artifacts, such as goods, raw materials, and buildings,

Table 1 The high-level NACE categorization system

G	Wholesale and retail trade; repair of motor vehicles, motorcycles, and personal and household goods ("trade services" for short; often statistics exclude the motor vehicles subsectors)
H	Hotels and restaurants (often identified as HORECA—hotels, restaurants, catering)
I	Transport, storage, and communication
J	Financial intermediation
K	Real estate, renting, and business activities
L	Public administration and defense; compulsory social security
M	Education
N	Health and social work
O	Other community, social, and personal service activities

though they may be embodied in such artifacts.) There are active efforts to develop classification systems for service products.[1]

Service *industries* and *firms*, unlike manufacturing, construction, and extractive (e.g., agriculture, fisheries, forestry, mining, petroleum, quarrying, and the like) sectors and firms, have as their main function the provision of service products. The North American Industry Classification System (NAICS)[2] and the Statistical Classification of Economic Activities in the European Community (NACE)[3] provide more detail on service industries than did earlier frameworks, such as the United Nations International System of Industrial Classification, though the level of detail is still coarser than for manufacturing industries. The high-level NACE categorization involves nine sections (***Table 1***).

The industrial categories presented in Table 1 are rather broad for undertaking a serious analysis of innovation processes. For example, transport and communication are combined, and within the latter, postal and telecommunication services are combined. More disaggregated data are increasingly available, but many lines of analysis, including international comparisons, are limited by a lack of statistical detail.

Services represent a huge range of industries. The *service industries* category carries a legacy of being the residual sector into which are put the leftovers, that is, all the industries that do not produce raw materials and tangible artifacts, as do the primary and secondary sectors. (The primary sector is composed of extractive industries, and the secondary sector consists of such industries as manufacturing, construction, and utilities. The tertiary sector is services, which was once known as the residual sector.)

However, the service products in which these industries specialize share two fairly common features: intangibility and interactivity. By *intangibility*, we mean that rather than being material products, service products typically involve transformations in such entities as the state of material products, of people (and other organisms), and in data. Some are delivered through physical artifacts (e.g., CD-ROMs and consultancy reports) and some are associated with them (e.g., dental fillings and credit cards). Such physical elements of services constitute a small fraction of the overall cost of the product. The more important costs stem from such activities as producing and delivering content on a physical medium, the transformations that the tangible artifact enables, and tailoring a transformation to the client.

By interactivity, we mean that many service processes require the presence and participation of the client, or *customer intensity*. Physical presence may be required for some kinds of transformations to a customer's state, such as transport from place to place, hairdressing, or providing some form of counseling. Sometimes customers are essentially passive and sometimes they are actively involved in the production of the service, for example, working out in a health club or debating business problems with a management consultant. Some service products are *self-services*, that is, they require some level of labor input from the client. Some involve clients designing the service jointly with the service provider. The numerous points of interaction with the service provider mean that many service activities feature more intimate producer–consumer relationships than is usual for manufacturers (especially those providing mass-production goods).

Discussions of service-dominant logic in marketing[4,5] and similar approaches in studies of innovation and internationalization[6–8] point out the limits of generalizing about services. First, some service

products and processes are fairly tangible and not particularly interactive: industrial cleaning firms produce tangible outcomes with little human contact needed, for example. Second, many manufacturing firms also produce intangible products (valued brands and relationships) and have high interactivity with clients (e.g., many specialized component suppliers). Service intensity and a strategic focus on service are growing across the economy.[9]

But service industries typically have progressed further in terms of intangibility and interactivity than most other sectors. These features are often associated with characteristics such as the following:

- *Coterminality*—Service product, process, and service consumption take place at the same time and place.
- *Low portability*—Difficulty storing and transporting service products; the service provider or client may need to move, and services export is thus often overshadowed by other modes of presence, such as foreign investment, franchising, and professional partnerships.
- *Information intensity*—Communication flows between service supplier and client, and, in data-related services, it flows to and from information processing, leading to, for instance, the exceptionally high levels of information technology (IT) use in finance and business services.

Three ways in which service industries vary, with high significance for their innovative activities, are the following:

- *Fundamental processes*—What transformations they effect on which objects determines the types of knowledge brought to bear in the service operations and the new knowledge required for innovation; broadly, there are three major types of objects being transformed:
  - *Physical artifacts*—Areas such as freight transport, repair and maintenance, and warehousing that are in the business of moving, storing, maintaining, and manipulating artifacts like goods, buildings, and even parks.
  - *People*—many public and personal services aim to change the states of health, social welfare, and the personal appearance of people (with parallel services for animals, such as groomers and veterinarians).
  - *Symbols*—Such services as those engaged in communicating and processing data, creating and providing information, and generating and reproducing knowledge, including financial services (processing information about property rights), telecommunications and broadcasting services (storing and moving signals), and consultancy services (imparting advice).
- *Knowledge intensity*—A reflection of the extent to which a service activity requires highly skilled service operatives who exercise professional or technical capabilities to produce situation-specific results; innovation processes are liable to vary according to the organization of the workforce.
- *Market relations*—How far they are serving (and are funded by) consumers, businesses, or the public sector and the extent to which the service is highly tailored to the specific client or service situation, as opposed to being standardized and mass-produced.

SERVICES AS PROVIDERS OF TRANSFORMATIVE ACTIVITIES

Input/output tables depict the inputs each sector of the economy consumes while it is making its products and which other sectors consume its outputs. (Other data sources may offer classificatory possibilities. Service occupations can be studied through statistical systems, as well as service products and sectors. Again, there are standard occupational classification systems. The U.S. Bureau of Labor Statistics coding of skill requirements in work has been used for sectoral analysis of technology change impacts by Hwang,[10] drawing on the work of Roos and Trieman.[11])

Figure 1 outlines the inputs of different services (plus the primary and secondary sectors) in such terms, using the U.K. 2004 input/output tables.[12,13] For inputs to physical transformations, we take energy consumption as a share of all consumption expenditure to be an indicator of the intensity of such activities. Informational transformations are reflected by investment in IT as a share of all investment (gross fixed capital formation). A rather more heroic assumption is that the share of consumption expenditures that goes to such items as food and drink, medical drugs, and furniture

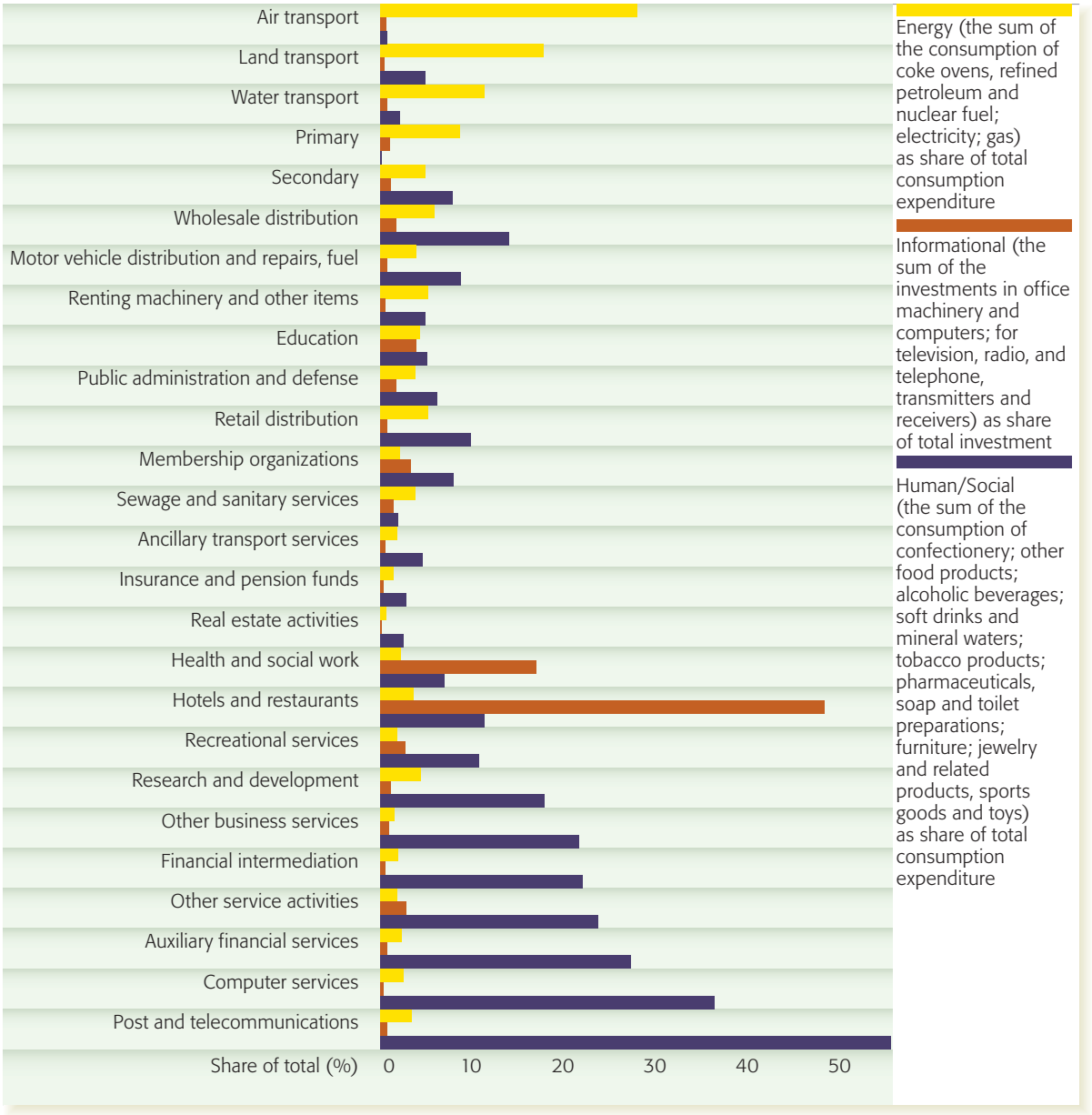

Figure 1
Inputs into major sectors, U.K. 2004

gives a reasonable indicator of the extent to which each sector is actively engaged with transforming human beings.

Apart from the inevitable arbitrariness in these indicators, the precise locations of sectors are liable to vary over time and across countries, but the overall picture is both striking and plausible. The primary and secondary sectors, together with transport services of various sorts, are the main energy-intensive sectors. Wholesale and, to a lesser extent, retail trade also feature here (these also use IT heavily), together with predictable cases, such as sewage and sanitation. Service sectors are very dispersed, with considerable variations in the balance between human, social, and informational activities. IT-intensive services include telecommunications, technology-based knowledge-intensive

business services (T-KIBS), and financial services. Hotels, restaurants, and catering (HORECA) and health services—because the indicators emphasize hospitality and accommodation—clearly stress human requirements. Some service sectors have low scores on all parameters, indicating that more subtle indicators may be required. In reality, many services effect more than one of the three types of transformation; for instance, doctors providing advice and surgery, transport services providing in-flight entertainment, and so on. Sectors such as education are tricky to classify: Are they mainly information services or do they transform the state of people through training, skill formation, and enhancing understanding? (In terms of these indicators, education appears to be fairly energy intensive.) There is much scope for further development of such empirical approaches, but these initial and broad-brush results underline the variety of transformations effected by service industries.

The nature of service transformations has substantial implications for innovation. Twenty years ago, Miles[14] noted that information services were being transformed through the use of new IT, while in human and physical services, the primary focus in larger organizations was on back-office applications. Human services employed sector-specific innovations (e.g., medicines and diagnostic equipment for health services) and applied IT to better capture and use data on the complexities and circumstances of individuals. Physical services made use of motorized transport and processing technologies, used IT in logistics, and faced the challenge of self-service, wherein consumers could acquire inexpensive new equipment to produce their own service functions conveniently. Different transformative activities involve inputs of different equipment and materials and the application of different skills and knowledge bases. Distinctive knowledge bases, professions, and communities of practice will influence the structure and conduct of innovation.

SERVICES AS PROCESSORS OF INFORMATION AND KNOWLEDGE

Data on types of knowledge in the economy are elusive, but data on accredited levels of knowledge are available. *Figure 2* presents EU data for the year 2000 on the extent to which the labor force is composed of people with high, medium, or low educational attainments.[15] The nearer to any apex of the triangle, the more that type of input dominates

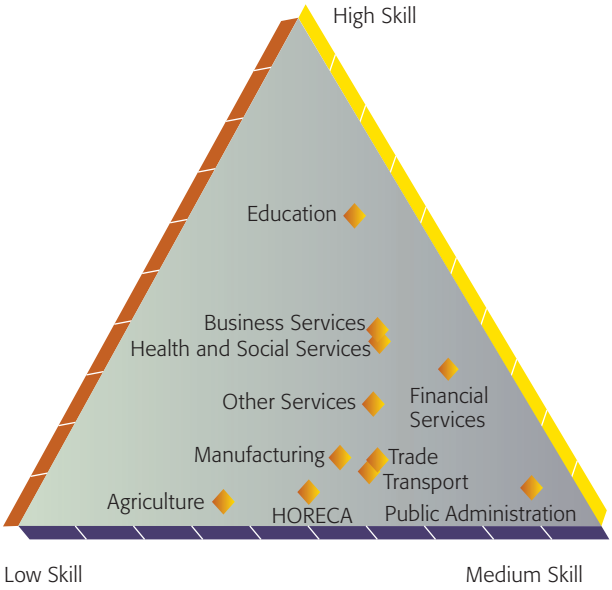

Figure 2
Skill composition of economic sectors in the EU for the year 2000. High skill = attainment of International Standard Classification of Education (ISCED) levels 5-7, medium skill = attainment of ISCED level 3, and low skill = attainment less than upper secondary education, i.e., below ISCED 3

sector inputs.[16] Studies of what jobs entail (e.g., Houtmans et al.[17]) broadly confirm that sectors with lower skills involve more monotonous and less responsible jobs.

Some service sectors that are oriented to physical transformations, such as HORECA, transport, and trade services, resemble manufacturing and agriculture in that they have high shares of low-skilled workers. Public administration has a remarkable share of medium-skilled employment: Government bureaucracies typically employ many office workers in routine information processing tasks.

Four service subsectors—health, financial, education, and business services—make intensive use of highly skilled workers. In health and financial services, highly skilled professionals apply specialized knowledge supported by semiprofessional and other staff to effect very different transformations. In health services, knowledge in areas such as biochemistry, physiology, pharmaceuticals, and surgery is applied to influence bodily well-being; information is exchanged with patients, communi-

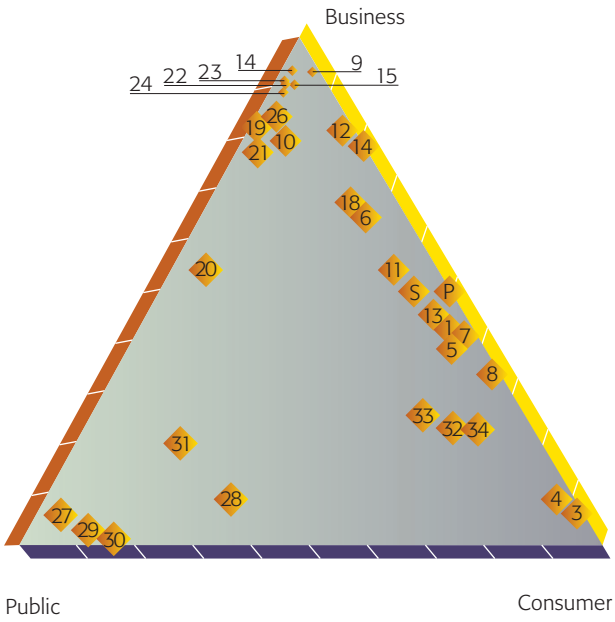

Figure 3
Destinations of output of major sectors of the U.K. economy, 2004 (See Table 2 for legend)

ties, and other practitioners about which behaviors may further support this. In many countries, health services feature large-scale R&D activities alongside more routine, testing-oriented laboratory work.

Financial services largely involve processing information about ownership rights and the value of money and monetized commodities and how these behave over time in varying circumstances. Information about changing conditions is exchanged with customers and investors, in some cases in amazing depth and with incredible rapidity. Both health and financial services create and use generic knowledge as well as developing highly localized knowledge of specific clients.

Educational services organize and reproduce knowledge, and train various levels of students (including training them how to learn), but they also provide some social service functions (e.g., child care). Higher education also hosts much public-sector research (i.e., knowledge production as well as reproduction).

Business services include both knowledge-intensive business services (KIBS) and more routine ones, such as cleaning, security, and call centers. KIBS involve applying specialized knowledge to effect transformations: writing and deploying software, for example, or designing new buildings. Some involve providing clients with information (e.g., advice from management consultants or marketing specialists), but many KIBS also create generic knowledge as a major activity, most obviously in activities like market research and R&D services.

Skill levels have complex implications for innovation. Fuchs[18,19] attributed the slow productivity growth of services to low-skilled workforces, but the rapid productivity growth in U.S. trade services in recent years makes this explanation less viable, perhaps reflecting the application of IT and new organizational forms. The professional knowledge of highly skilled workers and the new service approaches they develop in the course of their practice may be sources of innovative ideas. However, such workers may be able to resist management efforts to rationalize their work and threaten their expert status. Knowledge workers require novel management approaches.[20,21]

SERVICES AS PROBLEM-SOLVERS FOR SPECIFIC CLIENTS

Figure 3 displays input/output data[12] on the markets to which the different sectors of the U.K. economy were selling their products; as before, we might anticipate that the details will vary across countries and periods, but the general picture makes a great deal of sense. (see *Table 2* for legend.)

What statisticians classify as business services do indeed mainly support business markets (though R&D services in the U.K. notably have a large purchaser in the form of government). Many sectors (e.g., telecommunications) cater to both consumer and business markets. The governance and market structures of sectors like health, education, and broadcasting have varied over time and across countries, but in the U.K. in 2004, these are largely public services paid out of government funds. While innovations are often informed by the practical experience of service workers, sectors that deal intensively with other businesses may learn a great deal from their clients; consumer services often use market research to gain knowledge of their client circumstances and requirements.

The sets of data demonstrate that huge variations exist at a sector level in the markets, functions, and

Table 2 Destinations of output of major sectors of the U.K. economy (2004)

Codes for Sectors and the Structure of Outputs		Proportions of Output (%)		
Number/ Symbol	Sector	Business (Intermediate demand)	Households† (Final demand)	Government (Final and intermediate demand)
P	Primary	50.00	49.70	0.30
S	Secondary	50.00	43.59	6.41
1	Motor vehicle distribution and repair, fuel	42.51	53.35	4.14
3	Retail distribution	5.767	93.63	0.60
4	Hotels, catering, publications, etc.	8.499	88.82	2.68
5	Railway transport	22.86	63.86	13.29
6	Other land transport	67.43	24.94	7.62
7	Water transport	41.04	56.64	2.32
8	Air transport	33.49	65.14	1.38
9	Ancillary transport services	93.86	4.12	2.01
10	Postal and courier services	80.08	6.44	13.48
11	Telecommunications	54.33	37.84	7.82
12	Banking and finance	82.26	14.81	2.93
13	Insurance, pension funds	44.96	50.72	4.32
14	Auxiliary financial services	79.11	20.41	0.48
15	Real estate	92.10	0.13	7.77
16	Estate agent activities	91.31	2.30	6.38
18	Renting of machinery, etc.	64.89	27.73	7.37
19	Computer services	82.92	0.01	17.08
20	Research and development	54.37	5.69	39.95
21	Legal activities	78.46	2.50	19.04
22	Accountancy services	94.03	0.49	5.47
23	Market research, management consulting	94.52	0.00	5.48
24	Architecture activities and technical consulting	89.82	1.10	9.08
25	Advertising	92.19	0.39	7.42
26	Other business services	85.08	2.45	12.47
27	Public administration and defense	5.53	2.24	92.24
28	Education	8.51	32.73	58.76
29	Health and veterinary services	2.30	11.32	86.38
30	Social work activities	0.02	16.89	83.09
31	Sewage and sanitary services	19.72	18.71	61.58
32	Membership organizations	38.53	55.79	5.67
33	Recreational services	25.29	57.48	17.23
34	Other service activities	22.51	67.98	9.51

†Includes nonprofit institutions serving households (this is a small proportion of overall consumption expenditures). Source: Calculated from U.K. Input/Output Tables 2004,[12] "Combined Use Matrix" (for intermediate output) and "Combined Use Matrix continued" (for final demand)

employment structures of services. The size of service firms is also very variable. To take the case of legal services, the firms supporting private individuals are often small, even one-person practices, while those providing services to corporations may well be transnational organizations themselves. Practically all service sectors have a large share of small firms (often serving very local markets) and a small number of large and internationally active ones. With few exceptions (the most notable being financial services), service sectors typically feature a greater share of small firms than do manufacturing firms (Tether et al.[22] display European data). This is liable to have implications for innovation, with larger firms being more likely to organize the process in specialized functional groups.

SERVICE SECTOR INNOVATION

The first question considered here is, How can we characterize types of service innovation? We then go on to consider issues of innovation management in service firms and the broader organization of innovation in services. In all of these cases, there are likely to be substantial parallels when it comes to production of services in manufacturing sector firms.

Service innovation

Conventional descriptions of product compared with process innovation may be too grounded in a traditional manufacturing logic, not least because the distinction between product and process is sometimes problematic in service activities. den Hertog[23] suggests that service innovation is better thought of in terms of four dimensions of novelty:

1. *Service concept*—A service new to its particular market, or, in Edvardsson's terminology, a "new value proposition."[24,25] Many service innovations involve fairly intangible characteristics of the service, and others involve new ways of organizing solutions to problems (be these new or familiar ones). Examples might include new types of bank account or information services. In some service sectors (e.g., retail) there is much talk about *formats*, such as the organization of shops in different ways (for instance, whether they are more or less specialized or more or less focused on quality or cost-saving).
2. *Client interface*—Changes in the way clients are involved in service design, production, and consumption. For example, many services are introducing greater levels of self-service for clients.
3. *Service delivery system*—Changing the ways in which service workers perform their jobs delivering critical services. Much innovation concerns the electronic delivery of services, but there are also, for instance, transport and packaging innovations, such as the physical transport of pizzas.
4. *Technology*—Used in much process and delivery innovation, where new IT is especially important to services because it allows for greater efficiency and effectiveness in information processing. Energy and motor technologies are especially important in physical services, while health stands out in the human services for the range of pharmaceutical, genomic, instrumentation, and surgical technologies in use.

Innovation in each dimension involves particular sources of creativity and knowledge, raising issues of organization and management. Many service innovations involve some combination of these four dimensions. For instance, a new IT system (technology dimension) may be used to enable customer self-service using a Web site or automatic teller machines (interface dimension), or to enable a customer to determine the location of an item handled by a freight service (new service concept). A new service will often require a new service delivery system and changes to the client interface. A service innovation mainly involving one dimension may trigger the need for changes in other dimensions.

Dimension 1 relates especially to the characteristic intangibility of many service products, while dimensions 2 and 3 relate more to the client intensity or interactivity of service processes and products. Dimension 4 has more in common with traditional manufacturing innovation, with particular stress placed on new IT innovation (compare Figure 1). Innovations in any of these dimensions may be more or less incremental or radical, requiring more or fewer inputs of new knowledge and the reorganization of processes and procedures.

Surveys have been tracking innovation in Europe for well over a decade. The Community Innovation Survey[26] (CIS) has, since the mid-1990s, examined many marketed service industries. The surveys begin by asking whether the firm has introduced

innovations in goods or services to the market or innovations in production processes over the last three years. The distinction between product and process works well when one is dealing with manufacturers, but may be less helpful with services (where process, product, delivery, and consumption can be heavily entangled). They ask about investment in innovation and the sources of relevant information for innovation. There have been four rounds of the CIS, the latest three covering many market services, but no public services and only enterprises with more than ten employees. (This excludes much of the services sector, where small firms are prevalent, but many of these probably display little innovation. In almost all sectors, larger firms report more innovation and innovative effort. Computer services are apparently exceptional; compare Tether et al.[22]) The CIS focuses on the standard categories of technological innovation: product and process innovations. CIS4, the 4th round of the Community Innovation survey,[27,28] adds questions about new organizational and marketing strategies.

Most studies using CIS data have focused on the results for just one country. There have been few cross-national analyses examining services and using this data in depth: exceptions are Tether et al.[22] and Kanerva et al.[29] The typical result is that the services are found to be less likely to engage in innovative activity than comparable manufacturers. Manufacturing seems to be slightly more inclined to undertake process innovation and combined product and process innovation.

There is great variation among services. T-KIBS and financial services emerge as outstandingly innovative and have a tendency to combine product and process innovations. In terms of innovation, these sectors resemble manufacturing more than do other services (or the other primary and secondary subsectors).

Howells and Tether used the Innobarometer survey (involving just over 3,000 EU firms in 2002) to contrast manufacturing and service sector product, process, and organizational innovation.[30] Strikingly, over one third of the top service managers, but only 8 percent of manufacturers, considered their main innovative activities to have been solely organizational. CIS4 results from 2005 let us examine the types of innovation undertaken in various service subsectors in more detail. Kanerva et al.[29] report that service firms (especially in the financial and wholesale sectors) are more likely to initiate various types of organizational change. The tendency for services to engage relatively more in organizational innovation is in line with, but less marked than, Howells and Tether's result. Schmidt and Rammer[31] examined German CIS4 data, plotting technological (product and process) innovation against organizational change (including marketing change). *Figure 4* replicates this with U.K. CIS4 data.[26] The results (matched by more partial results from other countries, e.g., Kremp and Rousseau[32] for France) indicate two things: first, more technologically innovative sectors tend to be more organizationally innovative, and second, this correlation is imperfect, with manufacturing tending to emphasize technology-based product and process innovation while the service sector emphasizes organizational innovation. Service sectors with more focus on IT (Figure 1) are both more innovative and more focused on technological innovation; the reverse applies to services based more on physical technologies. Services more focused on transforming people are more oriented to organizational change.

These surveys ask about innovation expenditures directed to such areas as R&D and technological training, about collaboration for innovation, and about sources of information used. From Kanerva et al.[29] and earlier survey analyses,[33] we see that:

- Service firm innovation budgets, especially but not only for R&D, tend to be lower than those of comparable manufacturers (controlling, for instance, for size). But T-KIBS and high-tech manufacturing tend to have large budgets.
- In terms of intellectual property (IP), the patent mechanism (still oriented to primarily to tangible innovations[34]) is rarely used, except by some T-KIBS, such as engineering services. Trademarks are very important for some services. Though a new trademark does not necessarily signify a product innovation, trademarking and innovation are associated in many sectors.[35] Design rights are important in a few sectors to protect innovative engineering and architectural designs.
- Compared to manufacturing, most services (surprisingly) report less use of suppliers and customers as sources of information for innovation. Business services do report more use of clients, and trade services report more use of suppliers. Services recruit many employees from universi-

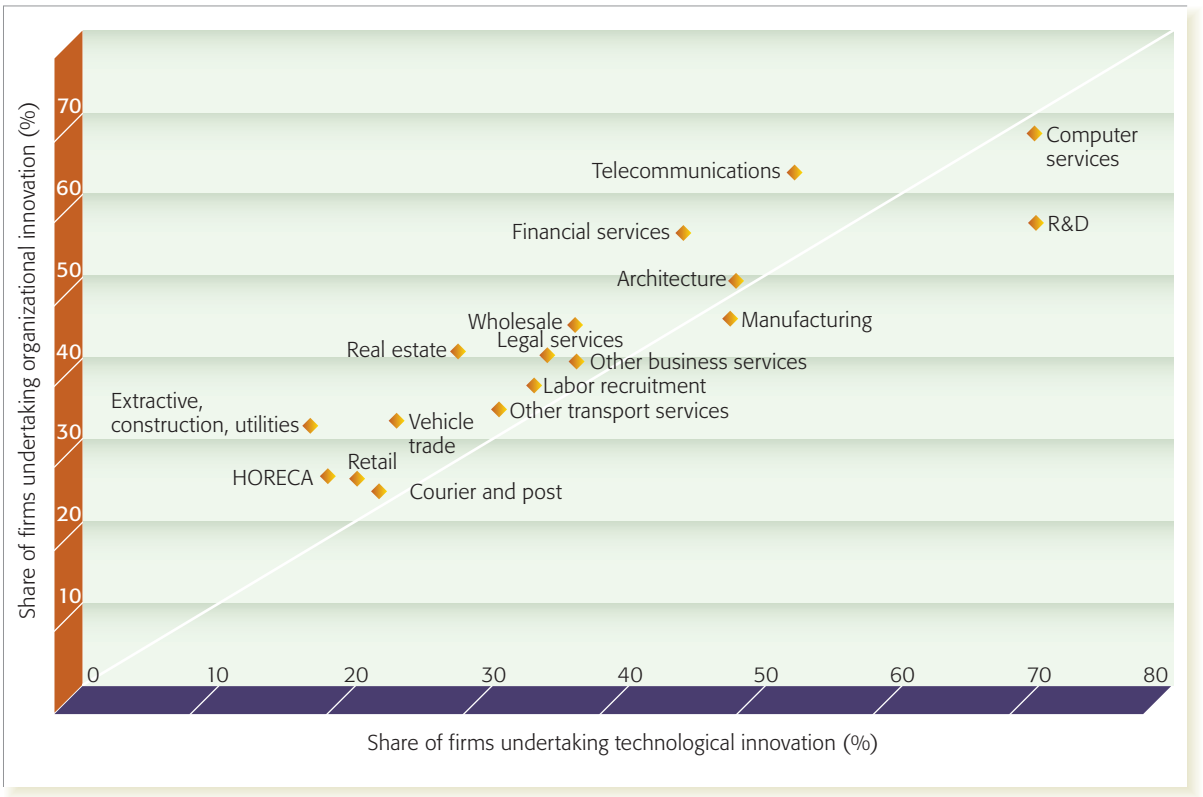

Figure 4
U.K. CIS4 data on technological change compared with organizational change
(The survey, conducted in 2005, asked about innovation in the years 2002–2004.)

ties, but, with the marked exception of business services, especially T-KIBS, make relatively little use of universities as sources of information for innovation and potential collaborators. They make slightly more use of consultancies and competitors as information sources.

Management of innovation in service firms

Innovation management in service firms has been studied mainly through case studies (e.g., Sundbo[36]). One set of studies of KIBS firms (Toivonen and Tuominen[37]), describes five innovation patterns in terms of their degree of formality and pattern of collaboration:

1. *Internal processes without a specific project*—Innovations emerge in an unintentional, unplanned, and incremental way; existing services are gradually adapted to new problems.
2. *Internal innovation projects*—Project-based innovation efforts carried out deliberately within the firm; usually focused on improvement of the service production system, but sometimes including innovations in service content.
3. *Innovation projects with a pilot customer*—The innovating service company seeks a pilot customer for its new idea; the customer supplies resources, sponsorship, critical evaluation, and information.
4. *Innovation projects tailored for a customer*—The client presents a specific problem and the service provider seeks a solution, with commitment to development activities often negotiated when the project is contracted (this may facilitate the reproducibility of the innovation, or limit it to remaining ad hoc).
5. *Externally funded innovation projects*—Usually formal and research-oriented; involving several collaborators and intended to generate new service concepts or platforms that benefit the whole sector or cluster.

Such rich descriptions suggest that it will be fruitful to examine relations among types of innovation and

service innovation processes as well as the firm-level management of innovations. The sector-level features of these processes, such as the degree to which innovation systems are embedded, must also be considered.

Several recent studies examine R&D-like activities in services.[38–41] In much of the service sector, it is rare to find firms producing new knowledge through R&D departments and employing specialized R&D workers and managers, or even using the term *R&D*. (*Research* is often taken to mean *market research* or *competitive intelligence*). Again T-KIBS are exceptions. Very large service firms in other sectors (such as finance and trade services) may utilize R&D departments, as do some public services.

In contrast, where service innovation is formally organized rather than treated opportunistically as a by-product of on-the-job activity, this tends to be through project-based teams, set up for the specific task at hand. Some firms, especially larger professional service firms, employ knowledge management systems to attempt to capture and build on innovations and innovation-relevant knowledge produced in practice. One major question is how far these features are reflecting innate features of services, for instance, their distinctive types of innovation requiring distinctive IP protection, and how far they simply reflect the heritage of services as relatively low-tech, local, and craft-oriented businesses.

Organization of innovation in service industries

The taxonomy of service innovation styles proposed by Soete and Miozzo,[42] while initially impressionistic, informs recent studies using CIS and similar data. Their sets of innovation styles are the following:

- *Supplier dominated*—This predominates in personal services such as HORECA, laundry, repair, barber, and beauty services. These are often small firms with little in-house R&D, engineering capability, or software production. Competition rarely depends on technological advantage, as it has more to do with skills, design, trademarks, and advertising. (We further note a strong tendency for such businesses to serve local markets and that this style characterizes many smaller firms in most services sectors, especially retail trade.)
- *Scale-intensive physical information networks*—Large firms in sectors such as transport and travel, wholesale trade, and distribution feature large-scale processes with a high division of labor, simplification of tasks, use of machinery, and IT applied for efficiency purposes (and, we would add, new services). Other network firms (e.g., in financial services and communications) focus on services delivered through information networks. Much of their machinery and hardware comes from manufacturing suppliers, but large network firms may undertake R&D and often do substantial work on systems design, specification, configuration, and integration. Where manufacturers have production engineers, this style of innovation may rely on network engineers.
- *Science-based and specialized suppliers*—Analogous to small, high-tech manufacturing firms (e.g., specialized instrument manufacturers) are T-KIBS specializing in R&D, software, information systems integration, and related activities. These activities develop and diffuse innovative knowledge. They are mainly business services (and we note that they can have strong links to universities); they have high levels of expenditure on innovation compared to most of the economy and focus more on R&D than other services. Some professional-based KIBS (P-KIBS) grounded in social research (e.g., polling, survey, and market research companies) have elements of this style of innovation.

Styles are only loosely associated with sectors within which there is variation, for instance, firms of different sizes with different market conditions. Using German CIS data, Hipp and Grupp[43] concluded that the Soete-Miozzo categories are reasonably effective descriptors of specific firms, but they found cases of each style in every service sector examined.

Recent reviews of the literature[22,29] suggest adding further styles to the Soete-Miozzo categorizations:

- *Professional knowledge-based style*—This style is closely associated with P-KIBS such as accountancy, legal services, advertising, and other traditional professional services. Some T-KIBS (e.g., architecture) make considerable use of this style. These services are intensive adopters of new IT and, in contrast to T-KIBS, are highly supplier driven. They apply a great deal of professional

knowledge in their practice and innovation; much innovation is on the job, developed on a one-time basis in specialized services: the big challenge is for the firms to reproduce and build on one-time innovations. Knowledge for innovation is mediated through professional networks. Professional associations are very important in this innovation style: They themselves offer such services as communicating information about best practices and new services and by providing training and quality assurance.[44] It is likely that analogous innovation organization characterizes some of the creative sectors, such as advertising and cultural services.

- *Public service style*—Soete and Miozzo considered public and social services (e.g., education, health care, and public administration) as largely supplier dominated. This is often true in terms of process technology innovations deriving from such suppliers as those of equipment, medicine, and software, but large public organizations (e.g., health care) often conduct their own R&D and have better links to the university system than do most private services. They have higher shares of professional staff than most of the firms in the supplier-dominated sector (Figure 2) and, while it is generally argued that public services have an innovation problem, some evidence[45] suggests that this is not always the case on a like-for-like basis. There are good reasons for considering this to be a distinctive innovation style (cf. Halvorsen et al.[46]), though it resembles the large network style in some respects.
- *Interactive style*—characterizes T-KIBS and P-KIBS, such as consultancy services, that are very closely involved with their clients in the production or coproduction of innovations. Problems are defined and redefined, and new solutions tried, requiring considerable information flows between service supplier and client. The KIBS extract knowledge of the local problem and circumstances confronted by the client and combine this with more generic knowledge to generate solutions. As well as being described in case-study work (in the KIBS literature, e.g., Miles[47] and Toivonen[48]), this sort of style emerges from survey analyses (e.g., Evangelista[49]).

With the extension of CIS-type surveys to more sectors and countries, and to include organizational as well as technological innovation, we can look forward to increasingly detailed and sophisticated exploration of service innovation patterns.

CONCLUSIONS

High innovation activity is recorded in some service firms and sectors, but not all styles of innovation are captured in conventional statistics or are targeted by innovation policies. It is important for service organizations, innovation policy, and for service management and training to take service innovation seriously. There are now signs that this is beginning to be the case on a much wider scale than we have witnessed before. Service sectors are shedding their image of being mainly non-innovative or mainly supplier driven. In marketing, the idea of a service-dominant logic is taking force.[50] It is beginning to influence innovation policy, as well.[51]

New service development research (e.g., Johne and Storey[52] and Nijssen et al.[53]), service marketing, and service innovation studies are converging in this respect. Likewise, they suggest that as service becomes a more important element of manufacturing processes and output, so innovation in service will become more critical for the manufacturing sectors as well. Manufacturing firms will find out how far the methods of innovation management to which they are accustomed are equally applicable to the demands of service innovation.

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