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What are service sector innovations and how do we measure them?

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Krzysztof Szczygielski *obtained his PhD in economics from the Warsaw School of Economics. He has been with CASE since 2001 working on projects on international economics, European integration and innovations. Since 2007 he has been a lecturer at the Lazarski School of Commerce and Law in Warsaw. In 2009-2010 he was a guest researcher at the TIK Institute at the University of Oslo.*

Abstract

Services dominate all advanced economies but service innovations are still an underresearched topic. One of the reasons are definitional and measurement difficulties. The goal of the paper is to highlight those by reviewing recent literature and to assess the current state of knowledge and challenges. Theoretical approaches, empirical techniques and selected empirical results are discussed. Apparently the biggest challenge, at this point, is to create a unified conceptual framework, that would encompass both manufacturing ad services. Meeting this challenge will, however, be difficult, given the strong focus on manufacturing, both in the literature and in the way enterprise surveys are designed.

1. Introduction[1]

Our goal in this paper is to unveil some key aspects of innovation in the service sector and to discuss the methods of measuring service innovation. Research on service innovation while no longer in its infancy, is still a kid brother of the rich literature on innovation in manufacturing. Consequently, there are still open questions as to the definition of service innovation and the appropriate way of measuring it.

In the following we review critically the debate on these two questions and assess the current state of the art. In Section 1 we discuss what service sector *is*. We continue by reviewing several theoretical approaches to how service industries *innovate* (Section 2) and related service innovation *measurement techniques* (Section 3). Selected *empirical results* are then appraised in Section 4. Final section concludes.

2. The service sector

Making generalizations about services is inherently difficult, due to an enormous heterogeneity of the sector, comprising, for instance, both, extremely high- and extremely low-technology activities (consider telecommunication on one hand and housecleaning on another; also cf. Miles 2005). For the same reason it is not a trivial task to define services in the first place. One way to solve the problem (or perhaps to circumvent it) it is simply to enumerate service industries, as is done by DTI [DTI 2007, p. 3]: "distribution, hotels and catering; transport storage and communications; business services and finance; government and other services" (what seems to missing here are the services provided directly to customers). Miles resorts to the NACE classification: "In the NACE framework, services 'sections' are: G (wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods – 'trade services' for short), H (hotels and restaurants – often shortened to HORECA, meaning hotels, restaurants, catering), I (transport, storage and communication – note that this includes electronic communications alongside more traditional activities), J (financial intermediation), K (real estate, renting and business activities), and a number of subsectors that are mostly not

[1] The author would like to thank Rick Woodward from the Glasgow University and CASE– Center for Social and Economic Research for his valuable remarks and comments, and Edward Grytsenko for his assistance work. All errors and ommissions are author's sole responsibility.

treated as market services, namely L (public administration and defence; compulsory social security), M (education); N (health and social work), and O (other community, social and personal service activities)." [Miles 2007, p. 251]. A more abstract approach is taken by Howells and Tether who distinguish four groups of services: dealing mainly with goods (such as transport and logistics), those dealing with information (such as call centres), knowledge-based services, and services dealing with people, such as health care ([Howells and Tether 2004] quoted after [OECD and EC 2005). In fact, a plausible definition of services, might be, everything that isn't agriculture,

Another way of defining the service sector is to try to look at the nature of services. Miles while stressing that any such venture must be subject to numerous qualifications, points to the following characteristics of (the most of) service products: intangibility; the interactive mode of production involving both client and supplier in the design, production, delivery, consumption and other phases of service activity; the "coterminality" of production and consumption; and in many cases reliance on IT [Miles 2005]). The difficulties associated with definitional issues regarding this sector are illustrated by the observations of Crespi et al. which, in contrast to Miles' coterminality finding, provide evidence that services often enable *separating* the production and consumption of goods (e.g. transport, retail and wholesale trade) [Crespi et al. 2006].

While Miles enumerates several characteristics of service industries, Sampson who represents the emerging "service science" insists that it is one of them that really matters: "Services are production processes wherein each customer supplies one or more input components for that customer's unit of production. With non-service processes, groups of customers may contribute ideas to the design of the product, but individual customers' only participation is to select, pay for, and consume the output. All considerations unique to service are founded in this distinction" [Sampson 2010, p. 112].

3. The nature and definition of service innovations

While providing a comprehensive definition of the services sector has already proved to be a nontrivial task, the problem of service innovations and their very nature has opened a genuine theoretical debate. Respective literature has been reviewed by several authors (e.g. [Coombs and Miles 2001], [Djellal, Gallouj 2001a], [Tether 2004], [Kanerva et al. 2006]), who have identified three to four theoretical approaches, partly consecutive and partly overlapping in time. The approaches are (to use the Kanerva's et al terminology): *indifference, subordination, autonomy,* and (sometimes) *synthesis*[2]. A more detailed characteristics follows:

The *indifference* approach has been predominant in the economic literature until the 1990s and consisted in ignoring services. Innovation studies at that time were almost completely restricted to the manufacturing sector (with possible exception of the research on the IT industry). A good example is the extensive work of Zvi Grilliches on innovation in American manufacturing.

Within the *subordination* approach, on the other hand, the service sector has been taken into consideration but it has been regarded as essentially non-innovative. According to this view, the principle source of innovation in services is new equipment. In other words, service innovation is restricted to adoption of innovative technologies from the manufacturing sector. One possible exception to this pattern are big companies producing standardized services (e.g. banks) which do innovate in a way similar to big manufacturing companies i.e. applying the inventions created in R&D labs. The subordination approach, while considered by many to have been overly narrow, has also produced some interesting theoretical and empirical work on the diffusion of manufacturing innovations in the service sector (cf. the Barras' theory of 'reverse product cycle' in service industries; [Barras 1986, 1990]; cited in [Miles 2005] and in [Gallouj, Weinstein 1996]).

The *autonomy* approach has been a reaction to that restrictive view of innovation in services. According to the "autonomists" service firms are important innovators, but service innovations are fundamentally different than manufacturing innovations. First of all, while the latter are based on new products and production technologies, the former rely mainly on new ways of organizing economic activities and on marketing innovations. Another hypothesis about the different natures of service- and manufacturing innovations has been formulated by Kanerva et al. in an attempt to explain the apparently very dissimilar performance of countries on the European

[2] Tether and Howells use other labels (*neglect, assimilation, distinction, synthesis*) for a similar classification ([Tether and Howells 2007])

Innovation Scoreboard (relevant mainly for technological innovations in manufacturing) and the Service Sector Innovation Index (see also next section). In their view "the nature of service sector innovation could rely much less than in manufacturing on the accumulation of capabilities, permitting service sector firms to move much more rapidly to best practice than manufacturing firms. Another way of looking at this issue is that innovation indicators in both the manufacturing and service sectors measure the *flow* of recent innovations (for example R&D expenditures in the previous year, or patent applications in the previous year). However, in the manufacturing sector these flows are strongly dependent on the *stock* of accumulated capabilities within each firm, whereas innovative flows in the service sector are not." [Kanerva et al. 2006 p. 39; emphasis added] This is an interesting hypothesis and certainly worth investigating, however we would argue that at this point there is not much evidence in support of it. Another point that Kanerva et al. make is that organizational innovations, characteristic for service industries might be easier to imitate than technological ones. This on one hand seems to be a plausible observation, but on the other hand, it is worth stressing that successful organizational change might be as difficult as a technological one, as evidenced by the extensive literature in management research (cf. [Anderton et al 1983], [Armenakis, Bedeian 1999])

Focusing on service innovations as a distinct phenomenon resulted in conceptual frameworks that can make it possible to analyze several relevant aspects of service innovations. One interesting idea by den Hertog is to think of service innovations in four dimensions: service concept (critical characteristics of the service), client interface (the way the consumer participates in service design, production and consumption), service delivery system (e.g. traditional vs. electronic) and technology ([den Hertog 2000], cited in [Miles 2008]) Of those four, only the last dimension has a clear counterpart in manufacturing innovations. Innovative service concept implies changing the type or the "format" of existing services and it has to do with the intangibility of services, while innovations in client interface and service delivery system modify the ways in which services are jointly produced and consumed.

Currently the autonomy approach seems to be quite strong (if not dominant) in the innovation research as evidenced by the evolution of the Oslo Manual. While the first two editions (1992, 1997) focused on product and process innovations, the third one (2005) addresses explicitly and at length organizational and marketing innovations and it discusses innovations in services [OECD and EC 2005].

This is not to say that drawing a strong distinction between services and manufacturing has not been criticized. Drejer argued that the definition of service innovation has become too broad to

be meaningful and that the difference between innovation and day-to day business has become blurred [Drejer 2004]. Moreover it is argued that by "concentrating on elaborating on the concept of innovation in services, we might be overlooking various forms of nontechnological innovation in manufacturing" [Kanerva et al.2006 p. 11].

We would argue, that indeed, the more elaborated the analytical models, the less compatible they are with innovations in manufacturing (try to apply den Hertog's framework to manufacturing). Consequently the underlying hypothesis of the different character of innovative efforts and outcomes in both sectors, becomes impossible to verify. Moreover the room for potentially fruitful comparisons and theoretical and empirical work is restricted[3].

In a response to these dilemmas some researchers have called for a *synthesis* approach, aiming at a general theory that could encompass both manufacturing and service innovations while taking into account those aspects of innovation that go beyond technology (e.g. organization or marketing innovations; cf. [Coombs and Miles 2000]). An early attempt was the article by Gallouj and Weinstein, who applied the Lancaster characteristics approach to product differentiation to describe innovations in both sectors [Gallouj and Weinstein 1997]. Drejer analyzed Schumpeter's seminal contributions in search for an inspiration for the new approach [Drejer 2004]. Generally speaking, however, the work in this field is certainly far from being completed and, as of now, there is no unified conceptual framework that would be accepted by most scholars. One obstacle may be that, as stressed by Tether and Howells, the synthesis approach aims at creating a theory that would be wider than previous conceptualizations both in terms of its method and its scope (in particular, considering more deeply the external relations of the firm, not only as factors but also as drivers of innovations). As a result it would require a more interdisciplinary perspective: "(…) aside from technological change this research is interested in organisational change, social networks, the development of 'integrated solutions', and a range of other mechanisms to support in innovation in services and manufacturing. This shift in emphasis requires incorporation of many tools and theories from outside traditional innovation studies, including organisational behaviour, social networks, marketing, strategy and communications studies" [Tether and Howells 2007, p. 35].

It is worth stressing that the differences in approaches discussed here are more than an intellectual exercise. Depending on the view on the nature of innovation that one adopts, one

[3] As Castellacci points out: " (...) the service innovation literature seems to be developing, to some extent, into a separate field of investigation within innovation studies, without much interaction with or relation to the well-established paradigm–regime–trajectory model already developed for the study of innovation in manufacturing industries." [Castellacci 2009, p. 279].

can arrive at different conclusions regarding, inter alia, the contribution of service innovations to aggregate productivity, the appropriate STI policy with respect to the service sector, and the correct method of measuring service innovations. We focus on the latter problem in the section3.

4. Measurements of service innovations

Innovation science relies on a range of statistical data sources that can be classified in seven groups (cf. [Smith 2005]):

1) R&D data
2) Data on applications for the protection of intellectual property right (IPR)
3) Bibliometric data (i.e. data on scientific publication and citation)
4) Direct innovation studies via enterprise surveys
5) Technometric indicators on the technical performance characteristics of a product
6) Synthetic indicators developed for scoreboard purposes
7) Databases on specific topics (e.g. regular surveys of a limited group of enterprises or studies of certain aspect of innovation activities)

Of those sources at least four – R&D, patents, enterprise surveys on innovation and synthetic indicators have been applied to investigate innovation in the service sector. We will present them briefly:

Ad. 1) While the limitations of R&D indicators as measures of innovation performance both in manufacturing and in services have long been acknowledged[4], they continue to be used in innovation studies, not least due to the favorable data availability. OECD collects data on R&D expenditure and personnel in both manufacturing and service sectors. The literature has consistently found that the R&D intensity of the latter to be much lower (while services dominate each of the advanced economies their share in R&D expenditure in 2005 ranged from 6.9% in Japan to 39.1% in the United States[5]) and the expenditure on R&D is typically concentrated in

[4] See e.g. Smith (2005). Some sectors are by their very nature more R&D-intensive than others. R&D expenditure and personnel measure if anything innovation *input* and not innovation *output*. What is more, many innovations are not based on R&D, and some innovations-related expenditure are not included in R&D spendings (e.g. design)
[5] Estonia with 82.5% was a clear exception (European Commission 2005, cited in Miles 2007)

few service sectors, most notably ICT. While acknowledging these disproportions, Miles argues that the picture would be more favorable for services, had it not been for the formulation of survey questions that focus on technological R&D and neglect social scientific R&D. He also points to the growing role of service sector R&D [Miles 2007].

Ad 2) Although patents are instruments used essentially in manufacturing, and many service innovations are not patentable at all[6] there have been some studies on the usage of patents by service firms ([Blind 2001] cited in [Miles 2007]). On the other hand, service firms more commonly apply for trademarks and copyrights ([Kanerva et al 2006]), however apparently there has not been much empirical work exploiting these data. A possible reason might be that while obtaining a patent poses a certain challenge for the applicant (the novelty of the invention must be argued), obtaining a trademark is easy. Therefore trademarks might be considered not to be meaningful indicators.

Ad 4) Enterprise surveys provide a direct measure of innovation and they are widely considered a major step advancing our knowledge of innovations. In particular the Community Innovation Survey (CIS) made it possible to track the innovation activity of companies in all the EU and several non-EU countries, and this according to the same methodology. The service sector has been making its way to the CIS gradually, in a way that largely reflected the sequence of theoretical approaches listed in the previous section and paralleled the evolution of the Oslo manual. While the first run of the survey (completed in 1993) did not include the service sector at all (cf. *indifference*), CIS-2 (1997) and CIS-3 (2001) did consider business services, but without any changes to the methodology, implying that the only innovations surveyed were new products and production processes. This can be regarded as reflecting partly the *subordination* approach: without organizational innovations being taken into account, services were determined to come out as supplier-driven innovators. An intense academic debate followed and several recommendations were suggested before the fourth edition of the survey in 2004 ([Djellal and Gallouj 2001b], [Tether and Miles 2001]). Some of these suggestions were implemented i.e. organization and marketing innovations were considered, others however were not (more specific contextualization of innovations) implying that the criticism remained partly unanswered. Finally the 2006 edition of CIS was implemented without major changes to methodology.

[6] Software is an exception but only in some countries (e.g. US)

Another enterprise survey that is conducted on a regulary basis in all EU countries is Innobarometer, a study realized annually since 2001 as a part of the ProInnoEurope project of he European Commission. The survey is based on telephone interviews by the Gallup Organization.

Ad 6) To create a synthetic indicator measuring the innovation performance of sector industries is the principal aim of Kanerva and co-authors. The result is the Service Sector Innovation Index (SSII) consisting of six sub-indices (human resources, innovation demand, technological knowledge, non-technological change, sources of knowledge/diffusion, commercialization, intellectual property; [Kanerva et al. 2006]). The detailed composition of SSII is presented in Table 1. The authors calculated the index value for several European countries, including almost all EU member states and for four business sector industries. The results are quite surprising with several countries scoring poorly on other innovation scoreboards being very strong according to the SSII. A related outcome is that the cross-country correlations between EIS (European Innovation Scoreboard) and the new SSII index and its subindices generally come out weakly. Although authors make several attempts to explain this result or to regard it from other angles (e.g. correlation for country groups), the puzzle still remains, suggesting that if the task is to have a reliable synthetic service sector indicator, further work will be necessary.

Table 1. Indicators forming the Service Sector Innovation Index (SSII)

HUMAN RESOURCES
1.1 Share of employees with higher education
1.2 Share of firms that use training
1.3 Lack of qualified personnel – *reversed indicator*
INNOVATION DEMAND
2.1 Lack of customer responsiveness – *reversed indicator*
2.2 Lack of appropriate sources of finance – *reversed indicator*
TECHNOLOGICAL KNOWLEDGE
3.1 Business R&D expenditures (% of value-added)
3.2 Acquisition of other external knowledge (% of turnover)
NON-TECHNOLOGICAL CHANGE
4.1 Non-technological changes – strategy
4.2 Non-technological changes – management
4.3 Non-technological changes – marketing
4.4 Non-technological changes – organisation
4.5 "Other" innovation expenditures (% of turnover)
SOURCES OF KNOWLEDGE / DIFFUSION

5.1 Share of innovative firms co-operating with others 5.2 High use of suppliers 5.3 High use of customers 5.4 High use of competitors 5.5 High use of research institutes 5.6 High use of universities 5.7 ICT expenditures (% of value-added) **COMMERCIALISATION** 6.1 Sales of new-to-market goods/services (% of turnover) 6.2 Sales of new-to-firm not new-to-market goods/services (% of turnover) **INTELLECTUAL PROPERTY** 7.1 Share of firms that use patents 7.2 Share of firms that use trademarks 7.3 Share of firms that use designs

Source: [Kanerva et. al. 2006, Table 1, p. 21]

5. Some results of the empirical studies on services innovations

There is now a wide body of empirical research on innovations performed by service companies. In this section we discuss some studies and literature reviews to relate to the theoretical approaches presented in section 2.

Starting with the question how innovative the service sector is, there is strong evidence that services are not merely adopters of “off the shelf” technologies, and that their innovation efforts go far beyond that. First of all, some (even if few) service industries invest heavily in R&D and big service companies are on top positions in the rankings of R&D spending ([Miles 2005]). Little surprisingly this applies mostly to the telecommunication sector (including broadcasting) but also railways have traditionally kept large R&D labs.

Moreover some studies show that services equal if not surpass manufacturing in the information-technology-related investment intensity ([Miles 2001] cited in [Miles 2005]). In this context it is worth stressing that IT adoption has played a dual role for the service sectors [cf. Bertschek et al. 2010]. On one hand, it represents a process innovation, facilitating the activities already in place and encouraging complementary improvements in human capital and firm organization.

On the other hand, and perhaps more importantly, the IT revolution enabled new firm strategies including an unprecedented growth in outsourcing of such services as accounting, human resources, marketing, software engineering and others. This has given rise to entirely new industries providing business process outsourcing (BPO) services, which are currently traded internationally at a considerable scale[7].

Studies based on the Community Innovation Survey, have shown that a considerable proportion of firms in service industries does introduce different kinds of innovations (and that number might be underestimated for the reasons specified in the previous section). On the other hand, most studies suggest that the "supplier-driven" model of innovation is indeed more widespread among service companies than it is in manufacturing. In other words, technology adoption is the principal source of innovation in services. Having said that, there are service firms that can influence their suppliers and impose the introduction of innovations on them (e.g. supermarket chains, cf. [Miles 2005]) and others that develop innovations in strong cooperation with customers (knowledge-intensive business services or KIBS). In other words, service firms play a variety of function in national innovation systems, and both the *indifference* and the *subordination* approaches discussed in section 1 have little justification

Is innovating in services (fundamentally) different from that in manufacturing? Several studies reviewed by Kanerva et. al suggest that at least within the well-established Oslo-manual-like classification it is quite different: as for the type of innovation, service firms more commonly rely on organization and marketing innovations and less on technological innovations; regarding innovation inputs, on average there is clearly less R&D spendings in services than it is in manufacturing; speaking of innovation outputs, there is less patenting ([Kanerva et al 2006, pp. 12-18]).

On the other hand, given the heterogeneity of the service sector, one can ask if the very question about differences between service and manufacturing innovation is correctly formulated. One way to deal with heterogeneity in empirical studies is to apply a taxonomy. Taxonomies of service industries were proposed by several authors ([Miozzo and Soete 2001], [Evangelista 2000] cited in Tether and Howells 2007), however the most recent and perhaps most promising idea is to embrace manufacturing and service branches in one single classification. Castellacci proposes a taxonomy that distinguishes four groups of branches, three

[7] According to the estimates the BPO services provided by Irish firms in 2001 were 8.1. billion dollars worth ([McKinsey Global Institute 2005, p. 13], which is more than 6% of Ireland's GDP

of which comprise both service and manufacturing industries[8]. He offers some (mainly descriptive) evidence of the validity of the taxonomy, however a more compelling evidence is still to be delivered ([Castellacci 2008]).

A joint analysis of manufacturing and services firms/industries can be regarded as an empirical counterpart of the *synthesis* approach discussed earlier. Let us note, however, that if right are those who believe that this emerging approach will have to reach to other disciplines for information and research tools, then there might be problem with data. While the CIS contains a lot of data, it is still the technology approach that dominates. Unless there is a major reform in the CIS, innovation scholars will probably have to base their research on case studies.

[8] See [Ewangelista, Vezzana 2010] for a firm-level study.

Conclusions

While the research on innovations in the service industries has undoubtedly made a considerable progress in the last 10-15 years, major theoretical and empirical still remain to be answered. As for the former, it is not clear if and how a unified conceptual framework could be elaborated that would encompass both manufacturing and service innovations. In fact, a large proportion of the work hitherto focused on the differences between the two.

The empirical literature has made it evident that there is a considerable amount of innovation in the service industry. However the measurement of that phenomenon and its comparison with innovation in manufacturing is still subject to a debate and requires further studies. It might be claimed that the current scheme of drawing and analyzing statistical data should be changed in order to catch some important aspects of service innovation (such as relations with the environment). But in any case a new and fascinating strand of research has opened.

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