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Services innovation: assimilation, differentiation, inversion and integration

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Abstract:

This chapter aims to provide a review of the literature on innovation in services and to focus on the analytical strategies carried out in order to fill in the innovation gap in the service economy (i.e. the difference between what the traditional innovation indicators are capable of capturing, and the reality of innovation activities undertaken in a given economy). Four analytical perspectives are distinguished in this chapter, which are labeled: assimilation, differentiation, inversion and integration. The *assimilation* perspective analyses innovation in services just as innovation in manufacturing, focusing on their relationships with technological systems. The *differentiation (or demarcation)* perspective focuses on services specificities and aims to capture innovation activity where the traditional (technologist or assimilation) gaze perceives nothing. The *inversion* perspective reflects the “revenge” of the service sector : it emphasizes the active role of KIBS in other sectors innovations. The *integrative or synthetic* perspective provides more a balanced view of innovation in services. It seeks to provide the same analytical frameworks for both goods and services, and for both technological and non-technological forms of innovation.

Keywords: Innovation, Research and Development, Information and Communication Technologies, Services, Knowledge Intensive Business Services (KIBS), Servicization

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Introduction

Contemporary developed economies can indisputably be described by two fundamental characteristics. Firstly, these are, definitively service economies. In fact, services represent more than 70% of employment, and value added and demand for services represents more than 50% of overall final demand. Then they are innovation economies. Indeed, never in economic history has innovation reached the level and the rate that it has in the era of information and communication technologies. Thus one talks of a permanent innovation economy, an economy of knowledge or of quality, of the net economy or the new economy. It should also not be forgotten that innovation and R&D are also “knowledge services”. As William Baumol (2002) rightly pointed out in a provocatively entitled paper (“Services as leaders and the leader of the services”), not only is research and development (and innovation) a service activity but it also and most importantly, occupies a privileged position among such activities.

An economy of services *and* of innovation, the contemporary economy is not, though, recognized, as it should be, as an economy of innovation *in* services. Theoretical constructions, such as political discourse and practices, are still tainted by a certain mythology which associates innovation (mainly technological product or process innovation) with the manufacturing sector and which therefore under-estimates innovation in services.

Contemporary advanced service economies are characterized by what could be called an “innovation gap”. This innovation gap measures invisible or missing innovation, that is the difference between what the traditional innovation indicators (R&D, patents, the technologist definitions of innovation) are capable of capturing, and the reality of innovation activities undertaken in a given economy.

One of the main explanations for this gap is that the question of innovation in services has for a long time remained confined in what organizational theorists call a « competence trap », the researcher and in particular the economist striving to apply available analytical categories (of which some are institutionalized in the official indicators), without being too concerned with how these categories fit in with an economic activity that is singular in many respects.

Despite the perspectives opened up by Schumpeterian theories from the beginning of the twentieth century, economic theory has developed in this way by favoring process innovation linked to technical systems (the innovation which can be explained by the concept of production function). Innovation in services has thus for a long time been synonymous with service firms and organizations adopting technical systems of an manufacturing origin, the central question being that of the impact of this innovation on a certain number of economic variables, such as productivity, employment, skills, the organization of labor, trade, quality.

The aim of this chapter is to evaluate the literature on innovation in services, and to emphasize the analytical strategies that are implemented to fill this innovation gap. This chapter thus distinguishes four analytical perspectives, which provide a useful heuristic grid to explain the different ways of addressing innovation in the services: assimilation, differentiation, inversion and integration (Gallouj, 1994, 1998).

The *assimilation* perspective analyses innovation in services just as innovation in manufacturing, focusing on their relationships with technological systems. As far as it focuses on innovation adopted from manufacturing sectors, the assimilation perspective is also one of *subordination*. However, *adoption* is not sufficient to capture the multiple links between technological innovation and services, and technology (especially “disruptive technology” in Christensen’s sense, 1997) should be recognized as an important innovation driver in services as well. There may in fact be many other types of relation between technology and services:

- *determination* relation, when the technological innovation determines the emergence of new service functions (e.g. computer services determined by the development of IT) or when services (and innovation in services) determine the technological innovation (e.g. large retailers putting pressure on the food industry in respect of the quality, packaging and environmental friendliness of products);
- *diffusion* relation, when some services contribute to the diffusion of technologies (especially high tech consultants);
- *production* relation, when service firms themselves design and produce technological innovation;
- *identity* relation, when the service provided constitutes the use value of the technology (speed, safety, comfort, etc. in the case of a car).

In the latter case, technology can be seen as a driver of theoretical integration and of the blurring of boundaries between goods and services. Indeed, goods (e.g. cars) are not anymore considered as hardware but rather like an experience of software (i.e. of service characteristics).

The *differentiation (or demarcation)* perspective focuses on services specificities, and aims to capture innovation activity where the traditional (technologist or assimilation) gaze perceives nothing. The *inversion* perspective reflects the “revenge” of the service sector: it emphasizes the active role of knowledge intensive business services (KIBS) in other sectors’ innovations. The *integrative or synthetic* perspective provides a more balanced view of innovation in services. This perspective is based on a characteristics-based approach of the product. It seeks to provide the same analytical frameworks for both goods and services, and for both technological and non-technological forms of innovation. The integrative perspective seems to fit very well with modern economies in which the boundaries between goods and services are blurring.

1. Assimilation and subordination: (new) technologies and services

The question of innovation in the services has long been almost exclusively associated with that of technological innovation. This idea of innovation, which prevails in the manufacturing industry, links innovation to the production of material artifacts. This is the reason why we have described it as *technologist* or *industrialist* (Gallouj, 1994, 1998), which others have subsequently expressed by the term « *assimilation* » (Coombs and Miles, 2000). In the services sector, the assimilationist perspective is coupled with a *subordination* perspective (Djellal and Gallouj 1999, 2001). In fact, innovation is seen from the viewpoint of the adoption of technical systems and generally not from the viewpoint of their production. In other words, the services sector adopts technical systems that are produced in the really innovative and dynamic sector that is the manufacturing industry.

This idea of innovation is reflected in the innovation indicators of national and international institutions (OECD manuals). It has obvious consequences for the nature of public policies that are implemented to support innovation and R&D. For a long time, these public policies did not concern services, since these were considered to be not very innovative and not involved in R&D. The few of them that carried out innovation were involved in technological innovation projects that could be adopted and supported by public policies that are directed towards manufacturing industry.

In this section, we try first of all to explain the reasons for the predominance (and the still real influence) of this assimilationist approach. We will then show that this approach is itself heterogeneous, that it comprises several empirical studies and a few theoretical models. We will conclude by presenting a certain number of developments that are changing the nature of this perspective.

1.1 The success of assimilation perspectives

The domination of this assimilationist (technologist or industrialist) perspective in economics and management research studies can be explained in different ways. The first explanation is the inertia of our analytical tools, which were created in and for a manufacturing economy and which are subject to a law of decreasing returns in an intangible, knowledge and (social) relations economy. The second explanation is the dramatic dissemination of informational technologies in the services sector, and more generally the fact that services are increasingly sectors that are intensive in technologies and in capital (contrary to the Baumol and Bowen (1966) initial hypothesis which defined services as “stagnant sectors” because of their relatively low technology-intensity). This invasive character of new technologies in services

is not questioned today, quite the reverse, which helps to not discredit assimilationist approaches. Recent studies (Djellal, 2000, 2001b) analyze the way in which informational technologies are now disseminated in the services that were traditionally characterized as non-informational (for example, cleaning, transport, hostelry, catering). Questions are related to the reasons for this "invasion" and its theoretical consequences. The main explanation put forward is the increasing complexity of the product in activities that were traditionally directed towards dealing with the processing of material objects. One would thus go from activities where the functions of processing goods and technical systems dominate, to more complex activities where the product is developed, to different degrees, in space and in time, by the processing of data, knowledge and relationships. The theoretical consequences envisaged are, for example, the appearance of a paradox of productivity in activities, which up to now seemed to have been spared from this phenomenon.

1.2 Different assimilationist approaches

There are many assimilationist (technologist or industrialist) studies. They are mainly empirical and often consist of analyses of the impact of the dissemination of technologies.

However, there are a very limited number of attempts at theoretical constructions. We will here account for two evolutionist-inspired works: Barras' reverse cycle model and the evolutionary taxonomies that aim to describe and analyze the trajectories of innovation in services.

1.2.1 The impact of informational technologies.

A considerable part of the literature devoted to innovation in services is in fact concerned with the consequences of introducing technical systems in service companies or sectors (Guile

and Quinn, 1988; Rada, 1987, Quinn and Paquette, 1990; Quinn et al., 1990; Hackett, 1990). To simplify matters, we can describe the expansion in these technologies by means of two innovation models: mainframe computers, on the one hand, and decentralized IT and networks on the other. A useful way of explaining, if not the results, then at least the principal general questions considered in this extensive literature (in terms of impacts) is to cross these two models with a group of basic economic variables such as employment, skills and organization of jobs, productivity, the tradable nature of service and its quality.

The mainframe computer model would thus tend to exert a positive effect on productivity and tradability, but a negative effect on employment and on labor skills. This innovation model corresponds to the computerization of the back office and aims above all to reduce the cost of service provision by standardizing jobs and operating economies of scale.

As for the model of decentralized IT and networks, this would rather tend to have a positive effect on employment (or on certain kinds of jobs), skills, tradability, but also possibly on productivity and the quality of the « product ». This second model changes the interface with customers (the front office). It generates economies of variety and reduces routine jobs in favor of commercial activities and consultancy.

The preceding comments do not represent answers or definitive results, but rather hypotheses. Whatever the innovation model considered, a large part of the literature consists of presenting one, several or all these theoretical hypotheses and their mechanisms, to compare these with reality and to try to interpret possible differences.

1.2.2 The reverse product cycle model.

Compared to the many analyses in terms of impact (on which it relies and some of whose results are extended) Barras's reverse cycle model (1986) is an unquestionable theoretical advance. This is a simple and rich in implications model that constitutes a theory of the diffusion of manufacturing technological innovation in services. It describes the cycle of innovation in services as the reverse of the traditional manufacturing cycle formalized by Abernathy and Utterback (1978). This reverse cycle, which results from different waves of computerization, successively links a phase of incremental process innovation, a phase of radical process innovation and a phase of product innovation.

Incremental process innovations appear in the back office of organizations. They obey a logic of efficiency and cost reduction. For example, this concerns the computerized recording of insurance policies, computerization of staff records and payrolls. Radical process innovations mainly concern the front office and are aimed at improving quality. For example, these concern on-line insurance policy quotations in insurance company offices, the installation of bank ATMs. As for « product » innovations, these cover all the experiences of tele-services. Home banking is the best illustration of this.

Even if it acknowledges that the innovation dynamic in services has a certain specificity, this model is assimilationist to the extent that it only accounts for the technological forms of innovation (for example, in the bank's case, home banking, but not the new financial products). It identifies a reversal in the product/process cycle, whereas these categories are not necessarily relevant in services. It thus contributes to the innovation gap. Moreover, its ambition of constituting a general theory of innovation in services is also compromised by its

exclusive orientation towards ICTs, while other technologies (which deal with the process of material or biological media) can play an essential role in innovation in the services.

1.2.3 Sectoral technological trajectories.

Another important theoretical reference deserves to be highlighted. This is the taxonomy of service firms' and sectors' technological behavior, proposed by Soete and Miozzo (1990). It belongs to the evolutionary tradition and is inspired by Pavitt's pioneering work (1984). While Pavitt believed that all services belong to the « suppliers dominated »¹ category (which means that they adopt innovation processes that have been drawn up in other sectors), Soete and Miozzo assume a heterogeneity of innovation behavior in services, by distinguishing: 1) suppliers dominated firms; 2) physical and informational networks; 3) specialized suppliers and science-base firms.

This taxonomy of services was the subject of a certain number of attempts at empirical validation on the basis of community innovation surveys (CIS). By relying on a certain number of indicators derived from CIS2, Evangelista (2000b), as well as Evangelista and Savona (2003), thus distinguish three sectoral innovation models in the services:

- 1) « Technology users ». This category brings together the most traditional branches of services, that is to say retailing, hotels, catering, transport, cleaning etc. These are sectors with a low propensity for innovation and which depend on industrial suppliers of technology.
- 2) « ICT users ». These sectors are characterized by their intensive use of ICT. These are in particular banks, insurance companies and other financial services, wholesale trade, advertising, etc.

¹ In a later work, Pavitt et al (1989) identify an « information-intensive » trajectory where there are some service activities.

3) « Science and technology (S-T) based sectors ». This sector includes R&D, engineering, technical consultancy, IT services. They are industries characterized by their strong innovation activity.

However, this theoretical recognition of the diverse technological behavior of service firms does not constitute a loosening of the assimilationist perspective, except in the subordination dimension (services are not only content with adopting technologies, they can also produce these). On the other hand, there is no relaxation in assimilationism from the viewpoint of the nature of the innovation favored (technological bias). Only technological trajectories are envisaged. However, we can reveal the existence of service and relational trajectories in services, and above all, different innovation trajectories seem able to coexist in a separate or hybridized way in service firms.

1.3 Partial relaxation of the assimilationist perspective

Without yet being able to talk at this stage of differentiation perspective (cf. section 2), we can identify a certain number of relaxations of the strictest assimilationist perspectives in a certain number of recent studies. This relaxation is not unconnected to changing in the nature of the product in services, a change resulting from ICTs. As we have emphasized, assimilationism takes two forms: that of the nature of innovation (mainly technological), that of the origin of innovation (subordination: adopted innovation, originating from the manufacturing sectors). Relaxing the assimilationist perspective can therefore be described in accordance with these two axes.

1.3.1 Autonomisation.

We can show the loosening, in some cases, of the relationship of subordination in innovation in services vis-à-vis industrial innovation. Whilst continuing to be focused on technological innovation, the assimilationist perspective can be relaxed in two different ways, which express an autonomisation of services or a reversal of the balance of power.

Firstly, we note that some firms are themselves in a position to produce their own technical systems. The literature provides many examples of this. Then we note that some service firms exert a decisive influence on the industrial suppliers that are dependent on them, so much so that a « consumer dominated » innovation trajectory had to be introduced, in contrast to Pavitt's « supplier dominated » trajectory.

1.3.2 Endogenisation of the NICTs.

Probably the strongest change to the assimilationist perspective is caused by changes in service relationships vis-à-vis the ICTs. A new attempt at the endogenisation of the NICTs in the service economy is also achieved. Indeed, services are no longer simply considered through their behavior in adopting these NICTs. They can play an increasingly active role in their production (cf. previous point on autonomisation) and in their diffusion. Moreover, service innovation often appears to be a hybrid category linking NICTs and an organizational engineering activity, that is, the Design and Development of organisational arrangements (Djellal et al., 2003). The NICTs are the initiators of significant innovations in the content and organization of service provision. They are not only concerned with the back office and improvements in productivity, but also (an underestimated subject), the front office and linking this with the back office.

This endogenisation of the NICTs results in new forms of interactivity and the construction of new spaces. If, as the literature considers, one of the fundamental characteristics of services is interactivity, it is not surprising that many recent works are concerned with the consequences that NICTs have on this interactivity, and more generally on the question of proximity and space (national or international virtual proximity, etc.).

2. Differentiation: The specificities of innovation in the services

The first research strategy implemented to fill the innovation gap opened by the assimilationist perspective, and to allow identification of the forgotten or hidden innovation forms, is the perspective that we have also characterized elsewhere as *service-oriented* (Gallouj, 1994, 1998), but that one could call a *differentiation* or *demarcation* perspective. This research program firstly emphasizes the specificities of the nature of innovation. But the question of specificities can also be stated and applied to other dimensions of innovation in the services: its organization, its determinants, its appropriation regimes, public policies to support research or innovation, etc.

2.1 Specificities in the form and nature of innovation.

This specificity of nature can be approached in a deductive manner. This is frequent in economics and in management (Chase, 1978; Bateson and Hoffman 1999; Grönroos, 2000; Gustafsson and Johnson, 2003). Indeed, the theoretical characteristics of services (in particular, their intangibility, their interactivity, etc.) are ideal-types, which allow one to formulate a certain number of hypotheses on the specificities of innovation in the services.

Likewise the interactive (or co-produced) character of service has consequences for the nature of innovation and its modes of organization and appropriation.

But, of course, this specificity of nature is above all addressed in an inductive manner. Empirical studies are becoming more numerous, these seek to emphasize the particular forms of innovation, which elude traditional (assimilation) perspectives. A certain number of theoretical studies have emerged which put forward local theories (that is, adapted to certain sectors of service) or which question existing sectoral taxonomies.

Thus, the vague and "dynamic " nature of the output entails a blurring of the boundaries between the different common analytical categories (product, process, organization), problems in counting, problems in evaluating the economic impacts of innovation. It facilitates imitation.

2.1.1 Intangibility, interactivity and their consequences on innovation.

Intangibility has a certain number of consequences for the definition of innovation in services. First, it entails a blurring of the boundaries between the different common analytical categories (product, process and organization innovations). Indeed, in services, the product is often a process, a sequence of operations, a formula, a protocol, a mode of organisation... Further, it should be noted that the fact that services are not necessarily embodied in technological systems that can be readily appropriated gives them a certain degree of volatility that means they can be more easily imitated by competitors. The nebulosity of the output also causes considerable difficulties when it comes to evaluating the economic effects of innovation (e.g. in terms of employment or effect on sales). Informational asymmetries, which are generally considerable in service transactions, especially because of the "nebulous" nature of the product, are undoubtedly further compounded when the proposed service is a

new one. This makes it even more difficult to persuade customers to pay the price of the innovation and to measure its economic impacts. However, on the other hand, intangibility makes it possible to envisage the existence of intangible product and process innovations, and also of forms of innovations seeking to make the service less fuzzy (for example formalization innovation, see below).

On the theoretical level, interactivity, the second specificity of services would seem to prohibit a linear conception of innovation. On the other hand, it is particularly consistent with an interactive model, like that advanced by Kline and Rosenberg (1986). This characteristic has also certain consequences for the definitions and indicators of innovation.

- It leaves considerable space for the various forms of custom-made or ad hoc innovation (see below).

- It highlights the possibility of client participation in the production of the innovation (collaboration). Thus the customer can be one of the actors in innovation, with the success of the innovation process depending on the quality of the interaction (Von Hippel, 2006 ; Lusch et al., 2007; Ulwick, 2002; Edvardsson et al., 2006).

- It reveals certain methodological difficulties when it comes to estimating the cost of innovation. In cases of custom-made or ad hoc innovation (especially in consultancy), the innovation process merges with the production process. The cost of the innovation equals the cost of delivering the service plus that of formalising or “registering” the results.

- It raises the problem of appropriation regimes. To whom does the innovation belong if it has been co-produced? This is not simply a technical problem (concerning the legal means of protection) but also raises the equally difficult question of the distribution of the fruits of a jointly produced innovation.

2.1.2 Empirical typologies: after the KIBS, an application to all services.

The first studies devoted to the specificity of the nature of innovation in services concerned a particular category of services (considered to be the most representative of the specificities of these activities), that is, knowledge intensive business services. Thus, in the case of consultancy, Gadrey and Gallouj (1998) renounce the product/process typology to put forward an innovation typology that takes account of the cognitive nature of these activities, which are defined as machines for handling knowledge to produce knowledge. They thus distinguish three forms of innovation: *ad hoc* innovation (co-construction with the customer of a new solution to a problem), a *new expertise field* innovation (detecting an emergent field of knowledge and providing consultancy in this field), *formalization* innovation (the implementation of methods aimed at making the service less vague). The methodology favored in this case is the qualitative survey.

These empirical studies of a qualitative nature were firstly extended by implementing quantitative surveys aimed at quantifying these, once the particular forms of innovation were recognized. In contrast to *subordinated* surveys implemented in assimilationist approaches, these new surveys, concerned with identification and measuring specific forms of innovation in the services, have been designated as *autonomous* surveys (Djellal and Gallouj, 1999).

But these typological studies have above all been revitalized by the proliferation of areas of empirical investigation. We have therefore left the area of pure services and knowledge intensive services (KIBS, banks, insurance firms), to take an interest in the specificities of innovation in services that are often considered to be less noble or less knowledge intensive (transport, cleaning, elderly care). It would be boring and pointless to explain the many *ad hoc* typologies outlined in the different activities. What should be retained from these studies is

that the non-technological forms of innovation, which generally escape traditional tools, are identified everywhere.

Other particular services activities have been the subject of typological studies, from the viewpoint of a differentiation perspective. These are complex services, inasmuch as they combine a considerable number of other elementary services. Tourism is an interesting example of this. As Caccomo and Solonadrasana (2001) analyze, (cf. also Sundbo et al, 2007), the whole problem in analyzing innovation in this activity depends on the fact that the tourist good is a mixed good, on the one hand linking complex goods which are defined as temporal sequences of market goods and services (transport, accommodation, catering, attractions and visits), and, on the other hand, public goods and services (natural heritage and natural sites, transport and signaling infrastructure, tourist offices).

2.1.3 Theoretical models: local theories and improvements in taxonomies.

Over and above the increase in ad hoc empirical typologies, seeking innovation specificities we can emphasize the existence of a reduced number of local theories of innovation. They concern a perspective of differentiation to the extent that they are characteristic of a given sector, whose particular behavior they analyze.

Thus large scale retailing is a sector which, particularly in the area of management sciences, has a number of "local" theories of innovation. This is the case, for example, of the accordion theories (1966) or the wheel of retailing (1958), which considers innovation in shop formats, like the succession of simplified systems (hard discount) and bourgeoisified systems (rich in services). C. Gallouj (2007) examines these different theories (in particular the theories of cycles) and highlights their inability to take account of the diversity of forms of innovation.

He therefore explores, in a detailed way, the multiplicity of forms of innovation in retail distribution, showing that if the introduction, even the production, of technical systems is important here, they do not exhaust the potential for innovation in this kind of activity, far from it.

The financial services also have certain theoretical models that can be considered as local theories of innovation. This is the case with approaches in terms of characteristics, which represent every financial product as a vector of characteristics of service, and innovation as the addition of new characteristics or the improvement of existing characteristics (Niehans, 1983; Desai and Low, 1987).

A certain number of studies are part of an evolutionist perspective, to consider innovation in services, from the theoretical viewpoint, in its diversity and in its dynamic. Indeed, as we have seen previously, the evolutionary taxonomies of technical change link given technological behaviours (or trajectories) to given firms or sectors. These taxonomies constitute an important step forward in understanding technological phenomena, but they reduce or under-estimate the extent of the diversity of innovation behavior, particularly in services. Thus, according to Pavitt (1984), services have a homogenous innovation behavior: that of "supplier dominated" firms. The taxonomy of Soete and Miozzo (1990), which, itself, is specially developed for services, brings to light a greater diversity of trajectories. But in the same way as that of Pavitt, it only takes account of technological trajectories. A functional approach to the "product", whilst remaining consistent with evolutionary hypotheses, allows one to consider new innovation behaviors or trajectories, and to break both with the technological determinism of traditional taxonomies, and the one-to-one nature of relations between business sectors and categories of the taxonomy. By using a functional breakdown of

the service, associated with the competences mobilized and the final service functions or characteristics, Gallouj (1999), Djellal (2001a, 2001b) introduce diversity at different levels: statically, in the forms and nature of innovation; dynamically, both in the multiplicity of trajectories, that is in the development of these innovations, and in the multiplicity of possible relationships between these trajectories.

2.2 Specificities of economic regulation and public policy

The particular nature of innovation in services has consequences for the indicators of international statistical institutions, for economic regulation, and for public policies supporting innovation.

To take account of the characteristics of services, the OECD had to undertake several revisions of the manuals which set out the guidelines on defining and measuring R&D and innovation: the Frascati manual on R&D indicators, the Oslo manual devoted to the indicators of technological innovation, the "patents" manual.

At the level of public policies supporting innovation, there is also the question of knowing if there is a need for a specific policy for innovation and R & D in the services (differentiation perspective) or if it is enough to transpose policies developed for manufacturing to services (assimilation perspective) or again if one has to draw up new policies which take it fully into account (integration perspective). The question of the nature of public policies directed towards innovation is therefore closely linked to that of the debate on the nature of innovation in the services.

The rise in the power of services and the improved understanding of innovation and R&D in services have led to questions about the development of specific policies for services. Thus, in 1998, then in 2003, the European Commission said it wished to develop specific policies to support innovation in services (European Commission, 1998, 2003). According to Rubalcaba (2006), the arguments in favor of an innovation policy specific to services are the following: The interactive dimension of innovation in services and the inability to distinguish the product from the process, a role for R & D that is less than that in industry, less visible results because of the intangible dimension of service, the risks incurred, which can be higher, and the greater market failures, a problem of innovation appropriation.

Barcet and Bonamy (2002) thus present reflections on the specificities of the economic regulation dynamic for innovation in services. According to these authors, services play an important role in the current economic dynamic, but the macroeconomic conditions of their success are seldom considered. By being interested in three forms of service innovation, (service innovation complementary to the supply of goods, service innovation linked to the development of information technologies, innovation in proximity household services), they show that changes in macroeconomic conditions are necessary so that service innovations can find their economic and social efficiency. These are related to the problems of the institutional recognition of these kinds of innovation (that is, their identification and their evaluation), the problems of temporality (insofar as new logics of the use of individual or social time are implemented in service innovation), the problems of learning (notably collective learning) and the problems of monetarisation (possibly by methods of financing that are themselves innovative) in an economic field that is not very developed and often non market.

Differentiation approaches are based on the hypothesis of the specificity of services, and particularly on their assumed intangibility and interactivity, which are considered to have consequences on the nature of innovation and on its modes of organization. However this hypothesis can be questioned in different ways. After all there are many exceptions to these specificities (intangibility is difficult to apply to services such as transportation, catering, etc. and ICT is likely to make services more tangible), but in particular they also manifest themselves in the process of producing goods. Intangible elements and interactivity are becoming increasingly important in manufacturing. In conclusion one can say that this convergence between goods and services militates in favour of an integrative approach of innovation.

3. Inversion: The role of services in their customers' innovation

We can go a little further into what one could call the «rehabilitation» of service activities in the economic dynamic. There is in fact a still stronger argument than demarcation (autonomisation) for questioning the assimilationist perspective, when it translates the subordination of services to innovation coming from manufacturing. This argument is that of the existence of a certain inversion in the balance of power between the industrial sector and the services sector. Some services (in particular knowledge-intensive services, and notably research and development, engineering and consultancy) are not content with innovating for themselves. They also play an extremely important role in the innovation of their manufacturing or service customers. They are described as machines to process and produce knowledge. They thus occupy an important position in firms' interactive learning processes and contribute to innovations which cover the entire spectrum of the company's functions: technological, legal, commercial functions, etc.

3.1 KIBS and their customers' innovation

The theme of the role of services in their customers' innovation in fact only constitutes a particular case of a more general reflection devoted to the activity of knowledge-intensive business service firms (KIBS). KIBS firms can be seen as organizations whose information and knowledge are both the principal input and output, and it is important at the theoretical level to distinguish what concerns the routine processing of knowledge and what concerns innovation.

The literature supplies a series of interesting analyses on this theme of the role of services in their customers' innovation. This includes relatively numerous studies on the externalisation of R & D activities, on the role of "intermediary public agencies" in the dissemination of scientific and technical information. Studies devoted exclusively to consultancy in information and communication technology rarely escape this question (Djellal, 1995). The analyses of Bessant and Rush (1995), those of Hales (1997), are concerned with the role of consultants in "technological transfer", whilst to some extent broadening the semantic content of these two terms: transfer is not reduced to its linear dimension and technology to its material dimension. The studies of Miles et al. (1994) list the different roles of knowledge-intensive companies and define these activities as users, diffusers and sources of innovation. At the macroeconomic level, by using data from input-output tables, Antonelli (1995), inspired by the methodology of the percolation processes derived from physics, analyses the role of information and communication technologies in improving "connectivity" (that is the number of connections established between agents of a network) and the "receptivity" of agents (that is, their ability to absorb information), thanks to an increased use of knowledge-

intensive services. More recent studies look more closely at this theme of the role of KIBS in other activities' and sectors' innovation (Muller and Zenker, 2001; Czarnitzki and Spielkamp, 2003; Toivonen, 2004; Wood, 2005; OECD, 2007).

3.2 A model of interactional innovation (Schumpeter III)

The different analyses and accounts previously mentioned can be unified and generalized (whilst opening up other perspectives, notably that of an improvement in the degree of variety in mechanisms and forms of innovation) in a model that can be linked to the Schumpeterian tradition. We have proposed to call this model « innovation model assisted by consultant », or more generally a model «of interactional innovation » or again « Schumpeter model 3 » to show the connection to, and coherence with, the Schumpeterian approach (Gallouj, 2002b and 2002c).

We should recall that the enterprise spirit was embodied in two successive (but not exclusive) models formalized by Schumpeter (1912, 1942): the entrepreneurial model (built on the symbolic figure of the individual entrepreneur) and the monopolistic model (in which the R & D department replaces the entrepreneur). These two models correspond to the historic development of capitalism and to Schumpeter's ideas. The shift from the entrepreneurial model (Schumpeter I) to the monopolistic model (Schumpeter II) thus consists of the endogenisation (at least partial) of innovation.

We believe that the model of interactional innovation that we are proposing extends the two Schumpeterian models in an interesting and unexpected way. It constitutes a new locus of expression of the Schumpeterian enterprise spirit: innovation can also come from interaction

with external knowledge providers. This model suits well for the role of KIBS in their client's innovation process. However it can be applied to intra-firm service relations. It can also be applied to inter-firm alliances, collaboration and cooperation, irrespective of the sector.

Just as moving from the Schumpeter I model to the Schumpeter II model characterizes the historical evolution of capitalism, the appearance of our new model to some extent constitutes an additional stage in this evolution. This stage, that Schumpeter could not have anticipated, corresponds to the explosion of the tertiary economy, and in this general context, to the advent of a knowledge-based economy, in which "grey matter services" or "complex services" or, even "knowledge-intensive services", represent the second knowledge infrastructure that supplements and competes with the traditional infrastructure, mainly comprising public education and research services (Bilderbeek, Den Hertog, 1997).

4. Integration: the same analytical framework for goods and services

The hypothesis that is made here is that of a convergence between goods and services, where on the one hand, one witnesses a rise in the power of service and the service relationship as a method of coordination between economic agents everywhere, in the industrial sector, but also in the agricultural sector (servicization), and, on the other hand, an "industrialization" of certain services. In other words, the specificities of services that were emphasized in the previous program would not really be specificities, and the efforts made in order to better understand innovation in services (their nature, their mode of organization) would not be a factor of divergence, but, on the contrary, a factor of convergence: manufacturing innovation should also be better understood *in fine*.

4.1 The blurring of the sectoral boundaries between goods and services

An increasing number of contemporary studies note a blurring of the boundaries between sectors and the nature of « products » (Barcet et Bonamy, 1999). Some studies (Broussolle, 2001) show that the NTICs (as a technical system shared by manufacturing and services) contribute to this « blurring ». Thus, technologies which were considered in assimilation perspectives as factors of the subordination of services to goods, are considered here as an integration factor. The general idea defended is that the value of numerous goods (manufacturing and agricultural) is supplied by services and innovation in services. The idea is not new, but it has been expanded by case studies rich in implications. Nahon and Nefussi (2002), for example, break with the idea of an agricultural product reduced to its material dimension, and reveal the high " services content" of the agricultural product. They also show to what extent innovation in agricultural activity is increasingly based on services. These authors devote a very perceptive case study to the case of the potato, which represents an astonishing field of innovation, relying on services and service content.

4.2 A theoretical construction of integration

Observing the blurring of boundaries leads naturally to a theoretical reflection aimed at proposing the integrative interpretation frameworks. This is not a new perspective since it is already present in the works of Barcet Bonamy and Mayère (1987) in France and Belleflamme, Houard and Michaux (1986) in Belgium, and also in management and marketing literature (Grönroos, 1983; Norman, 1984). More recently, Gallouj and Weinstein (1997) and Gallouj (2002a) have developed this theoretical (integrative) perspective using a characteristics-based approach inspired by the Lancasterian representation of goods proposed

by Saviotti and Metcalfe (1984)². Taking into account services specificities (interactivity, intangibility), Gallouj and Weinstein define the product (whether this is a good or a service) as linking different vectors of characteristics [Y], [T], [C], [C'] (cf. Figure 1) :

- [Y] represents the service characteristics, the final users' value (for example, in the case of a car, its size, performance, comfort...; in the case of monetary and financial instruments, liquidity, divisibility, yield, income, ease of change, risk..).

- [T] represents the (material or immaterial) technical characteristics of the product. Vector [T] comprises the characteristics of the various (technological and non-technological) processes (back office or front office technical systems, methodologies...) mobilised to produce services characteristics [Y].

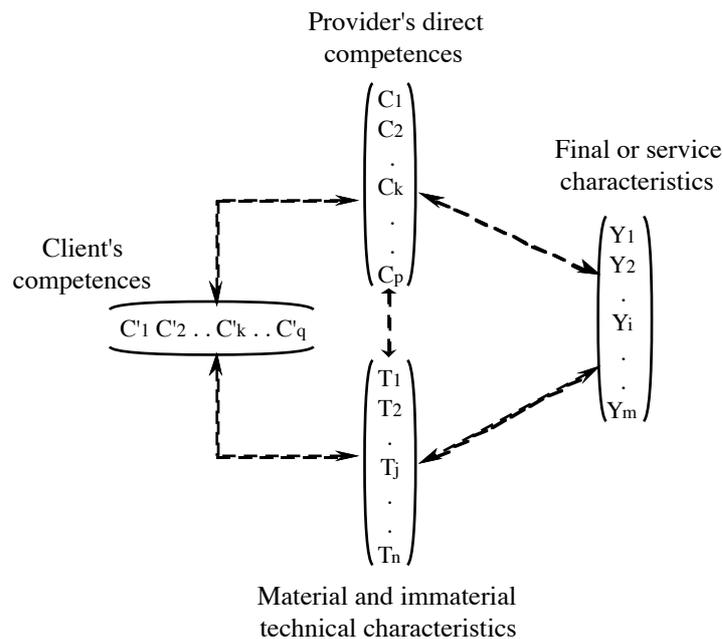
- [C] and [C'] indicate the competence sets of the supplier and the customer-user respectively. The vector product [C][C'] is the supply-delivery interface between producers and users.

The delivery of a service could therefore be defined as the simultaneous employment (and relationship) of technical characteristics (material and immaterial) and competences (internal and external) ultimately used to produce the service (or final) characteristics. This representation encompasses a number of particular cases: for instance, a pure service is given by the direct employment of the competences and service characteristics vectors [C]-[Y]; the relation [T]-[Y] represents a pure material good; the link between [C]-[T]-[Y] identifies a self-service relationship. It should be noted that the relationships between the different vectors can have different meanings (mobilisation of resources, interaction, etc.). For example, the relationships between technical characteristics [T] and service characteristics [Y] in goods are not the same as those between [T] and [Y] in services. In the case of goods, the technology is intrinsic, since it provides the use (or final or service) characteristics. On the other hand, the

² Lancaster' representation of the product is focused on service or final characteristics (Y). Saviotti and Metcalfe's purpose is technology measurement: therefore their representation of goods link these service characteristics to technical characteristics (the technical features of the good).

technology is not consubstantial with final characteristics in the case of services, except to some extent in the case of certain “quasi-goods” that are defined ultimately as the collective or temporary provision of “capacities” (ATMs, rentals of all kinds). It is an external factor in the production of service characteristics. If absolutely necessary, the service could be provided without it. The service may be embodied not in technologies but in competences called on directly or in an organisation.

Figure 1: The product as correlated vectors of characteristics and competences (Gallouj and Weinstein, 1997)



Innovation is, then, viewed as a dynamic of characteristics, which functions according to a simple arithmetic: addition, subtraction, association, dissociation, formatting of characteristics. They can be "programmed", that is intentional, deriving from voluntary R&D

activity, from design, from innovation, or "emergent", that is, the result of natural learning mechanisms.

Such a definition allows us to show several models of innovation:

- Radical innovation, which reflects the creation of a new group of characteristics {[C'*], [C*], [T*], [Y*]}
- Improvement innovation, which reflects the increase in "significance" (or quality) of certain characteristics without modifying the structure of the system {[C'], [C], [T], [Y]}.
- "Incremental" innovation, which is given here a specific definition as far as it describes the addition (but also possibly the suppression or substitution) of characteristics.
- Ad hoc innovation, a solution which allows a given customers' problem (legal, organizational, strategic, technical...) to be solved with some degree of novelty.
- Recombination innovation. This model of innovation relies on the basic principles of dissociation and association of final and technical characteristics.
- Formalization innovation, which reflects the formatting and standardization of characteristics.

This general representation of the product (good or service) can be improved in different ways: on the one hand, by introducing customers' technical characteristics (T'), which would allow the new channels of consumption and delivery (for example, when a consumer uses his own technologies to access a service on the web) to be taken into account; on the other hand, by introducing other providers' skills and technologies, when the service provision is carried out in a network (De Vries, 2006). It can also be useful, particularly to explain innovation in the public services, to include the public authorities in the model (Windrum and Garcia-Goni, 2008). Djellal and Gallouj (2005, 2008) also use this model to explain, in a more operational

way, innovation in “assembled” services, that is, services which (like hotels, retailing, hospitals) are the result of combining a variable number of other basic services. The model is used both as a tool to audit what already exists and as an instrument for identifying potential for future innovations.

4.3 The consequences of integration

Integration amounts to treating goods and services in the same way. However, it is not about assimilation. In fact, services are not considered to be goods, nor, moreover, are goods considered to be services. It is about an integration, which synthesizes the specificities of goods and services. Thus, the integrationist approaches explain both technological innovations and non-technological innovations.

The representation of figure 1 can be used very flexibly. It can enable one to explain a material artefact (a car or a computer), like an intangible product (an insurance contract, a financial product, consulting service). It can explain a pure service, just as a less pure service or, even, self-service provision ([C']—[T]—[Y]). Moreover, it is also able to illustrate the supply of hybrid solutions (goods and services): for example, a car and different kinds of associated services linked upstream and downstream (insurance, maintenance, financing guarantees...). These hybrid solutions allow us to understand to what extent innovation in a given good can be based on innovation in associated services, or conversely, innovation in a given service can be dependent on innovation in associated goods. Overall, the integrationist representation allows the innovation gap to be filled, not only in services, but also in goods (by accounting for numerous innovations in industrial services offered as complements to goods).

Conclusion

If for a long time it has seemed incongruous to link the terms « service » and « innovation », (service reflecting the negative images of servitude and public services); this is no longer the case now. Services and innovation are not two major contemporary phenomena, parallel but fundamentally different from each other. Quite the reverse, service firms and organizations are the location of Research and Development efforts and of considerable innovation, which are equal to their contribution to national wealth. Growth in the tertiary sector does not, therefore, constitute a challenge to Schumpeter's theory of « waves of creative destruction », according to which non-innovative firms and sectors disappear in favor of firms and sectors which introduce new « productive combinations ». It is perhaps simply a new illustration of this.

However, to be fully aware of innovation efforts in services, the analysis (whether economic, sociological or managerial) should itself accept certain efforts to adapt, or even conceptual and methodological innovation. The traditional analytic tools are not always able to take account of the new services and knowledge economies. To a certain extent they contribute towards locking analyses in what the organizational sciences call, in a metaphorical manner, a « skills trap ». Of course, this need for conceptual innovation also leads to the necessity to adapt actual measurement tools. Researchers' efforts thus converge and intersect with those of national and international statistical institutions.

However, it is important to recognize that the dynamic of services, and that of other sectors of the economy, are characterized by a similar dialectic of convergence and divergence. This dialectic is thus expressed, for example, by a certain universality of the « service dimension »,

or of the service relationship, or even « servuction » (Eiglier and Langeard, 1987), which transcends sectoral boundaries to creep into the heart of industrial production, but also agricultural production, and there to open the path to new forms of innovation (intangible products and processes, tailor-made innovation, ad hoc innovation), as well as new methods of organization of, and incentives for, innovation. This dialectic is also expressed by the universality of new information and communications technologies (NICT), which introduce material anchor points into the services. These facilitate, if not a certain form of industrialization of service provision, at least « industrial rationalization », which links these to traditional forms of innovation without, however, dismissing the existence of specificities of nature. Therefore researchers' efforts should be focused both on researching possible specificities, but also on integrating innovation analyses, that is, on the construction of general theoretical models which are independent of sectoral contexts.

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