

**THE DIFFERENT APPROACHES TO THE STUDY OF INNOVATION
IN SERVICES IN EUROPE AND THE USA**

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ABSTRACT

Innovation in services is a hot topic since the 1990s, but little attention has been paid until today to the applied side of this research field. In this work we consider the features of two fundamental, large-scale, innovation surveys: the European CIS and the American SIRD / BRDIS. Innovation surveys are the main tool through which innovation data are gathered, and these data become more and more important to test theories and to provide ground for innovation policy.

Once the characteristics of both surveys have been identified, we carry on with our analysis in two ways. First, we match the surveys with the theories; secondly we provide a comparison between the two surveys. The different paths undertaken by the European scholars on the one hand, and the American scholars on the other, are explicitly indicated.

Keywords: Innovation in services; Community Innovation Survey; SIRD / BRDIS.

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1. INTRODUCTION

Since the 1990s the understanding of innovativeness of the service sectors has become a central issue of the broader field labelled as the economics of innovation. While many analyses are concerned with the theoretical side, little attention has been given to the most basic-level applied side, namely that of the questionnaires and surveys which are used in order to grasp the principles which lead and direct that same innovativeness.

It is important to know the way in which these surveys are structured, starting from the questionnaires which are used to gather information. Obvious though it may seem, the results we get depend on the questions which are asked, and these latter are never neutral. What is meant by “innovation” in the service sectors is far from being univocal, and it becomes fundamental to know which aspects of innovation are investigated.

In this paper we fill a gap which still largely exists in the analysis of the applied side of innovation literature, with a specific focus on innovation in services. We thus provide an analysis of the contents of the European Community Innovation Survey (“CIS”) and of the American Business R&D and Innovation Survey (“BRDIS”, formerly “SIRD”).

Three reasons justify the specific attention devoted to these two surveys: first, the European Union and the United States are still leaders in innovation – despite competition coming from other advanced and emerging economies –, and it is important to have a deeper understanding of how they study innovativeness; thus, second, we have to refer to the two fundamental large-scale surveys which have been carried out systematically and consistently since a long time in the EU and the USA; third, CIS and BRDIS constitute a benchmark for surveys carried out in other countries.

Worthy an explicit comment is the fact that CIS and BRDIS constitute a basis for policy making in Europe and in America and are widely referred to in European Commission and White House documents, respectively (see European Commission 2015 and Hill 2013).

Furthermore, these surveys acquire particular importance in providing the ground to policy measures in different ways. Let us clarify what we mean by making use of the example of CIS. The

questionnaires are assembled and elaborated to provide “direct” information on innovativeness of firms; however, the same data is used to produce further “indirect” indicators such as, for instance, the European Service Innovation Scoreboard, or ESIS: as one can see in Annex 1, ESIS indicators measuring service innovation use CIS as a source in 16 out of the 21 indicators explicitly referring to services (European Commission 2014, p. 19, three central columns).

A further step of the analysis consists in providing a comparison between the two surveys: as we shall see, despite the fact that there exist acknowledged guidelines on how to collect innovation data throughout the so-called *Oslo manuals* – three editions of which have been published by the OECD –, the European and the American surveys are characterised by structural differences.

Our analysis contributes to clarify why since the 1990s European scholars have a leadership in service innovation studies, both at the theoretical and applied levels. This status quo is far from being “logical” when we consider the efforts carried out by American (or America-based) scholars: just think of the names and works of Kuznets (1957), Fuchs (1968) and Griliches (1992).

As clarified above, we are interested in the applied side. However, the latter is connected with the theory and other analytical components exemplified, for instance, by the Oecd *Oslo Manuals* – where, as we also hinted above, one finds explicit guidelines and operational definitions concerning innovation. Thus, we believe that a better understanding of the overall argument requires a (short) preliminary discussion of the theory – also because we will provide a matching between the surveys and the theories – and of the bridging operational sides. Put in another way, we will refer to three dimensions, i.e. theory, operational framework and surveys, concentrating our analysis on the third. Improvements on the theory of innovation in services have taken place at increasing speed during the 1990s, leading to a real explosion of attention in the early 2000s (for a review see Gallouj and Savona, 2009). Economic theory has evolved into three main different approaches to innovation in services, namely the *assimilation*, *service-oriented* and *integrative* approach (see, e.g., Drejer 2004); a fourth one, defined as *segmentalist* might emerge (Howells 2010).

Guidelines for collecting and interpreting innovation data and measuring innovation have experienced quite a few improvements, neglecting at first services and including them in later efforts (OECD 1992, 2005, 2010; Griliches 1992; OECD-Eurostat 1997).

This work is articulated as follows. Section 2 provides a résumé of the different theoretical approaches concerned with innovation in services as well as a synthesis of the issue concerning the indicators; let us emphasise that it does *not* aim to be a literature review, but provides the ground on which we can carry out our further analysis. Section 3 investigates the interaction between the theoretical and applied side. Section 4 considers the contents of the European large-scale survey CIS, while section 5 does the same for the American surveys SIRD, later BRDIS. Section 6 concludes providing a comparison between the two types of surveys, matching them with the available theoretical approaches.

2. SERVICE-SPECIFIC INNOVATION THEORIES AND INDICATORS

The early studies by Stigler (1956) and Kuznets (1957) identified the quantitative importance of services. These were, basically, descriptive analyses. Theorising on this sector and on *innovation* in services began much later: we have to wait until the 1980s in order to have broad service-dedicated studies (e.g. Gershuny and Miles, 1983; Petit, 1986) and the very first contributions concerned with innovation in services (Barras, 1986a; Barras, 1986b, Soete and Miozzo, 1989). Dealing with services has always been a difficult task: as many scholars have pointed out, problems concern definitions, classifications, measurement and indicators for innovativeness (e.g. Dean and Kuntze 1992; Cainelli et al. 2006; Lööf and Heshmati 2006; Schettkat 2007).

Our analysis will be focused on the way in which innovation data are gathered through large-scale surveys in Europe and in the United States. However, for the sake of clarity of our core work (sections 4-6), a necessary step consists of providing a brief résumé of the theories of innovation in services (subsection 2.1) as well as a short analysis of the main innovation indicators identified (subsection 2.2).

2.1 Hints at theories of innovation in services

The early explicit efforts to understand patterns of *innovation* in services emerge in the 1980s. The works by Barras (1986a) and Soete and Miozzo (1989) on services reflect similar efforts previously made by other scholars with respect to manufacturing (e.g. Freeman, 1974, 1982 and Pavitt, 1984). It is important to stress the fact that the studies concerned with *manufacturing* innovation have provided a lot of ground to the studies concerned with service innovation. Since the 1990s we have a crescendo of interest in innovation in services.

Three approaches to innovation in services have been explicitly identified (Morrar 2014; Gallouj and Savona 2009; Coombs and Miles 2000), while a fourth one seem to be emerging but has not (yet?) found much room (Howells 2010) in the economic literature on innovation in services.

The first approach is referred to as the *assimilation approach*: innovation essentially means *technological* innovation and innovative processes in services are assimilated to the ones which take place in manufacturing. Let us remind that Soete and Miozzo's (1989) and Evangelista's (2000) taxonomies belong to this approach even though they go beyond the simple idea of services as passive adopters of technologies. Barras' seminal paper (Barras 1986a) falls within this approach when one considers what he says about the transmission of technology and about the way in which innovation takes place in services.

The second framework is addressed as the *service-oriented (or demarcation) approach*: the specific characteristics of innovation in services are stressed in the belief that "innovation in services is different in nature to innovation in manufacturing" (Tether 2005, p. 155). This approach stresses the peculiar intangible and interactive nature of services (Castro et al. 2011).

The third approach is referred to as *integrative (or synthesis)*: as the definition clarifies, there is the ambition of reaching one single theory that is well-suited to the understanding of innovativeness in both manufacturing and services. Such a theory obviously considers services' peculiarities, taking into account both technological and *non-technological* forms of innovation. This approach has been developed by Gallouj and Weinstein (1997; see also Gallouj 2000) and it applies a perspective that

goes beyond the manufacturing–services dichotomy (Solè Parellada *et al.* 2011). According to this approach, some neglected aspects of innovation such as non-technological ones – which are prominent in services and are widely distributed throughout the economy – can be considered (Tether 2005). The fourth approach is defined as *segmentalist*: as the word clarifies, services are too big a sector to be encompassed within a single, all inclusive, framework, so that one has to refer to different segments within the sector itself (Howells 2010).

2.2 Technological and non-technological innovation indicators

The difficulty in the identification of service-sector-specific indicators originates from at least three sources: (i) services intrinsic nature (immateriality, consumption often simultaneous to provision and other service-specific characteristics); (ii) heterogeneity: the expression service *sectors* – in the plural – clarifies the point; (iii) a sort of initial theoretical lock-in due to the fact that in the early stages innovation in services was looked at with the lenses used to study innovation in manufacturing.

In the early stages of the analysis of innovation in services the *assimilation* approach has prevailed. Consequently “traditional” indicators used within manufacturing were transferred into services. This basically means R&D, acquisition of patents, workers holding a science and engineering degree, on the input side; and productivity growth, patents gained and new services, on the output side (Preissl, 2000).

However, while R&D and patents can be effective indicators for innovation in manufacturing, they might not be the most suitable indicators for innovation in services. Service companies usually do not pursue “classical” R&D and the innovation process does not necessarily aim to acquire technical know-how, so service patent applications are a small share of total applications (Hipp and Grupp 2005).

Given these premises, the fact that services were characterised as laggard and scarcely innovative does not come as a surprise.

The strength of traditional indicators lies in that they have a well-established background, in the way in which they are structured and in the possibility to make comparisons between (sub)sectors and through time. However, as Djellal and Gallouj (2010) clarify, innovation in services partly escapes traditional measurement: the use of traditional tools creates an *innovation gap*, so that *actual* innovation is higher than *measured* innovation, and the more economies are service-based, the wider the innovation gap.

Structural change, characterised by an incessant dynamics in which services have acquired more and more importance, calls for further innovation indicators which, in addition to the “simple” technological ones, ought to take into account organisational and social aspects of the innovation process.

This is what has happened with the establishment of the *service-oriented* and *integrative* theoretical approaches. In fact, since the mid-1990s, many scholars (e.g. Brouwer and Kleinknecht 1997; Marklund 2000; Miles 2005; Abreu *et al.* 2010) have highlighted the need to widen the innovation perspective, also shedding light on the positive effects which derive from the combination of organisational and technological innovations (Tether and Tajar 2008; Sapprasert and Clausen 2012). As Hipp and Grupp (2005) put it, the question is which other route is taken to generate innovations. The answer is not straightforward. The concept of innovation should be expanded considering specific services characteristics which affect the way in which innovation is performed. Organisational knowledge, new methods in selling and marketing, workers’ skills, experience and extensive contact with customers may play a central role in the innovation process. Likewise, the blurring boundaries between production and consumption in services lead to the introduction of the concept of delivery innovation which covers process- and product-oriented issues (e.g. self service equipment). Change in the above-mentioned aspects of the activity of a firm should be considered forms of innovation.

A further refinement of the tools has taken place in a fairly recent Oecd publication explicitly concerned with measuring innovation. In particular, *trademarks* are considered as indicators of

innovation: trademarks not only distinguish a firm's good or service from those of other firms, but also convey information on product, marketing and other service innovations (Oecd 2010, p. 24). Thus, according to OECD, expenditure on innovation should include traditional items such as R&D, or the expenditure incurred by firms for the acquisition of new machinery, equipment and software, but should take also into account the expenditure incurred for the attainment or acquisition of trademarks, besides patents, licenses and other types of knowledge (Oecd 2010, p. 78).

As one can see, one runs the risk of watering down the concept of innovation: a trademark may well represent a *competitive* advantage for one company over its competitors, but this advantage cannot be said to be based necessarily on an innovation.

3. THEORETICAL APPROACHES AND DATA COLLECTION

In the previous sections we have discussed some key issues which have been central to building a theory of innovation concerning services. We have now to take into account what has been done on the applied side. In Europe and in the United States there exist surveys aimed at understanding innovation characteristics since a long time – see next sections.

In this and in the next two sections we investigate if and how theory has affected data gathering. In order to do this we need to perform an intermediate step, that is to refer to the “guidelines for collecting and interpreting innovation data” proposed by the Oecd.

A further step will recall the distinction between two types of surveys according to theoretical classifications (see subsection 3.2). Then – in sections 4 and 5 – we will match the European and American surveys with the theoretical approaches summarised in section 2.1.

3.1 *A guide to collecting innovation data*

As we hinted above, a bridge between theory and empirical analysis is constituted by the Oslo Manuals, three editions of which have been published between 1992 and 2005. The guidelines

constitute a middle ground between theory and applied analyses in that they provide rules according to which innovation data have to be collected *and* interpreted.

The Manuals constitute, at the same time, an arrival and a departure point, as they synthesise the efforts of the scholars which have contributed to the debate, opening new ground for further analysis. Incidentally, let us also note that the three editions of the Oslo Manual reflect the broader evolution of the analysis of innovation from the linear to the chain-linked model of innovation. The former is based on the linear sequence: basic research, applied research and development, and production and diffusion (Godin 2006), the latter takes into account complex interactions and the existence of feedbacks (Kline and Rosenberg 1986; Smith 2005).

In the first two editions of the Manual (Oecd 1992; Oecd-Eurostat 1997) “innovation” is explicitly qualified as “technological”. Considering *technological* innovation reinforces the role played by manufacturing and thus the idea according to which R&D and patents are a good proxy for innovativeness. As for innovation in *services*, no trace at all can be found in the first edition of the Oslo Manual (Oecd 1992).

Things partly change in the second edition, despite the fact that attention was focused on product and process innovation and that non-technological innovations were dealt with in the Annex. In this edition of the Manual (Oecd-Eurostat 1997) the importance of services innovativeness is acknowledged: “it is already clear that services are the main users of innovation generated in manufacturing industries. Recent R&D surveys suggest that they are playing an important role in generating knowledge. In many fields the limit between industry and services as innovative sectors is blurring ... Hence the need to extend innovation surveys to the services.” (Oecd 1997, pp. 29-30).

Despite this acknowledgement, some difficulties made it impossible to consider innovation in services properly at the time; the difficulties indicated are: the peculiarities of the service industries; the statistical difficulties in handling innovation in services such as finance, communications, entertainment and some other services; the sampling problems in order to study small innovative service firms; and the service sector heterogeneity (Oecd 1997).

We have to wait for the third edition of the Oslo Manual before services are given full attention (Oecd 2005). In particular, the fact that in services innovative efforts are often less formally organised, may be more incremental in nature and less technological is explicitly acknowledged; furthermore, the definition of innovation is expanded so as to include *organisational* and *marketing* innovations – both are non-technological. In this way a more complete framework is created (Oecd 2005, p. 11)¹.

Despite the fact that the Oecd Manuals synthesise twenty years of efforts by the scholars who have dealt with innovation (and innovation in services from the second edition of the Manual), the various Oecd countries have developed different domestic paths in order to gather statistics on innovation, while some countries have been more active – European countries in particular – than others.

3.2 Theoretical classifications for the innovation surveys

Innovation surveys are the main tool through which innovation data have been gathered. Let us emphasise once more the fact that the data gathered in this way have become more and more important to test theories and for innovation policies (see, e.g., Cainelli *et al.*, 2006; Canepa and Stoneman 2008; Frenz and Ietto-Gillies 2009; Abreu *et al.*, 2010; Fagerberg *et al.* 2012).

According to Djellal and Gallouj (1999) and Drejer (2004), one can distinguish between *subordinate* and *autonomous* surveys depending on the theoretical issues they account for. Subordinate surveys mirror the assimilation approach, because they concern only technological innovation using, also for services, definitions and questionnaires designed for manufacturing. Autonomous surveys are developed within the service-oriented approach and they are exclusively applied to service firms taking into account the specificities of services.

¹About agreed guidelines to collect and interpret data, worthy of comment is the Iberoamerican Network of Science and Technology Indicators (RICYT 2000); in this context was developed and published in 2000 the Bogotá Manual which established criteria for standardising technological innovation indicators for Latin American countries. This Manual tries to balance the need to take into account the specific characteristics of innovative firms in Latin America with the criteria and procedures established by the Frascati and Oslo Manuals.

Because of the extreme heterogeneity of the service sector, Djellal and Gallouj suggest using questionnaires tailored to homogeneous sub-groups of services: an idea which is in line with the segmentalist approach.

Worthy of a comment is the fact that no proper synthesis approach could be referred to in the surveys in the recent past: Drejer, writing in 2004, explicitly said that the *synthesis approach* was still in infancy.

In the next two sections we investigate the way in which the surveys in Europe (CIS) and in the USA (SIRD/BRDIS) have evolved. It is important to note that both surveys were originally addressed to manufacturing, and later have been extended to services. We will consider the structure and the evolution of the questionnaires, which, in turn, reflect the theoretical and measurement issues. Put it another way, the description of the questionnaires allows us to go back to the theoretical approach on which European and American surveys are based. As we shall see, the recent evolution of the CIS surveys, is paving the way for surveys which can be classified under the “synthesis approach” label.

4. THE EUROPEAN MEASUREMENT APPROACH: COMMUNITY INNOVATION SURVEYS

The first Community Innovation Survey (CIS 1) was conducted in 1993 in order to investigate the dynamics of technological innovation in European *manufacturing* industries during the period 1990-1992. The second CIS round (CIS 2) took place in 1997 and, after the acknowledgement of the importance of the tertiary sector, was extended to include selected services and utilities²; however the main focus was still on *technological* innovation. Questionnaires were distributed to firms employing 20 or more employees, while from CIS 3 onwards the questionnaire was sent to firms with 10 or more employees and it was extended to the entire service sector. Since 2004 the

²Eurostat suggested including the following sectors: wholesale; transport; telecommunications; financial intermediation; computer and related activities; engineering services; electricity, gas and water supply.

survey is mandatory for EU members on the basis of a Commission Regulation and it takes place every two years instead of four.

As we have just mentioned, CIS 2 marks the introduction of services: two types of questionnaires were distributed within the CIS 2, one for manufacturing, and another one for services. Despite the fact that the questionnaires were distinct for the two sectors, the differences between them were trivial, and this is the likely reason which induced Eurostat to go back to one single questionnaire from CIS 3 onwards.

Let us here clarify that the analysis contained in this section stresses the presence and evolution of the questions aimed at dividing technological from *non*-technological forms of innovation in the various CIS rounds. In this respect, the viewpoint here contained is complementary to the one adopted in another work (Vergori 2014), which goes into different details and which was not aimed at an international comparison.

Table 1 summarises and compares the main questions asked from CIS2 onwards. The main areas of investigation have been divided into four groups according to the object dealt with.

From the table there emerges that, since the beginning of the CIS experience, the focus has been on five issues, namely (i) the types of innovation activities and their costs, (ii) sources of information for innovation, (iii) cooperation arrangements with other enterprises or institutions, (iv) factors that hamper innovation activities, and (v) government support.

These issues are aimed to investigate the environment in which innovation is performed, providing information on stimuli and obstacles to innovation, possible cooperation with other firms and typologies of innovation. This information may be useful for the choice of policy instruments to support innovation activity of the firms.

TABLE 1 : MAIN QUESTIONS OF THE CIS QUESTIONNAIRES

	CIS2 1994-96	CIS3 1998- 2000	CIS4 2002-04	CIS5 2004-06	CIS6 2006-08	CIS7 2008-10	CIS8 2010-12
General information about the enterprise	X	X	X	X	X	X	X
Basic economic information	X	X			X	X	X
<i>Questions about obstacles and stimuli to innovation</i>							
Ongoing/abandoned innovation activities		X	X	X	X	X	X
Factors hampering innovation activities	X	X	X	X		X	X
Government support	X	X	X	X	X	X	X
Public sector procurement							X
Innovation co-operation	X	X	X	X	X	X	X
Sources of information for innovation	X	X	X	X	X	X	X
<i>Questions about effects and objectives of innovation</i>							
Effects of innovation		X	X	X			
Innovation objectives	X				X	X	X
Innovations with environmental benefits					X		
<i>Questions dealing with technological innovation</i>							
Product innovation		X	X	X	X	X	X
Process innovation		X	X	X	X	X	X
Intellectual property rights	X	X	X	X			X
Innovation activity and expenditure	X	X	X	X	X	X	X
<i>Questions dealing with non-technological innovation</i>							
Organisational innovation		X	X	X	X	X	X
Marketing innovation		X	X	X	X	X	X
Creativity and skills						X	

Both technological and non-technological innovations are dealt with in the various CIS rounds. Technological innovation is detected through questions on product and process innovation, intellectual property rights and R&D. Worthy of a comment is the fact that the items “product” and “process” innovation were introduced only from CIS 3, the obvious aim being that of investigating the introduction of new or significantly improved products (goods or services) and processes (production process, distribution method or supporting activities), with respect to the market or the firm. Over time these questions have substantially remained the same.

In CIS 2 the question on intellectual property rights was restricted to the application for patents. From CIS 3 to CIS 5, it has been widened involving other protection methods, such as trademarks, copyright and registration of industrial designs, while it has been removed in the CIS 6 and CIS 7 rounds. Questions concerning intellectual property rights have been reintroduced in a broader

context, devoted to competitiveness of the firm, in CIS 8 (which refers to the years 2010-2012). In particular, it is worth noting that trademarks have been included, excluded and then reintroduced. Let us here remind, as we hinted at in section 2.2, that the Oecd gave an explicit indication to consider trademarks as an innovation indicator in 2010 (Oecd, 2010).

It is important to underline a point here: despite the theoretical efforts aimed at stressing the importance of non-technological factors, accompanied by the Oecd guidelines in the same direction, to find useful indicators is not an easy task. Put in another way there emerges once more the elusive nature of innovativeness in services, as well as the risk to water down the concept of innovation itself. This negative emphasis will be mitigated hereafter, when we refer in more detail to the questions on non-technological innovation as proposed in CIS 3 and later surveys.

About R&D, it was dealt with in the section devoted to “innovation activity and expenditure” jointly with other activities, such as for example acquisition of machinery and industrial design. The information required by the questionnaires concerns both any expenditure for intramural and extramural R&D, and the frequency (“continuously”, “occasionally”, “not at all”) with which enterprises engage in R&D. Although R&D has been considered from the beginning of the European survey it has always had a marginal room in the survey.

Non-technological innovation has been investigated since CIS 3 in a section of the questionnaire entitled “other important strategic and organisational changes”. This section was made up of a single question with a “yes” or “no” structure which took into account five different activities, namely: new corporate strategies, advanced management techniques, new organisational structures, new marketing strategies, and significant changes in the aesthetic appearance or design of the marketed activity or product. In the subsequent CIS rounds non-technological innovation has been analysed in more detail. In CIS 4 a section entitled “organisational and marketing innovations” was introduced. It involved two questions. The first one shows a “yes” or “no” structure and refers to the introduction of organisational and marketing innovations. The second question aimed at evaluating the relevance of the effects of organisational innovation in terms of: time to respond to customers’

or suppliers' needs; quality of goods or services; average costs; and, finally, employee satisfaction and/or employee turnover. From CIS 6 onwards, there were two separate sections devoted, respectively, to organisational and marketing innovation, but the way in which non-technological innovations have been dealt with was substantially the same as that used by the previous CIS.

CIS 7 introduced some novelties which concern non-technological innovation. For the first time, in the area devoted to "basic economic information on the enterprise" firms are asked to provide the percentage of employees with a university degree. In addition, a section labelled "creativity and skills" has been introduced. It is aimed both at identifying the methods used by the firms in stimulating new ideas or creativity among the staff and at distinguishing the skills employed in-house and those obtained from external sources. These questions investigate the relationship between innovation and knowledge embodied in workers themselves, which could be a useful indicator of non-technological innovation. Alas, the section "creativity and skills" has been removed in CIS 8.

A section devoted to "innovations with environmental benefits" was introduced in CIS 6 (and removed in CIS 7). This section was articulated into three subsections: the first investigated the benefits due to product and process (e.g. reduced CO₂, reduced energy use); the second considered the reasons which led to environmental-friendly innovations (e.g. regulations, taxes on pollution, voluntary agreements); the third subsection investigated whether the firm had systematic procedures aimed at reducing the environmental impact.

The way in which environmental issues have been considered in the different CIS rounds deserves some more attention. In fact, leaving aside CIS 6, from CIS 2 to CIS 8 no whole section of the questionnaire is explicitly devoted to environmental issues: what one can find are only two questions within a broad section which tackles the objectives (or effects, according to the CIS round) of innovation.

Deletion of the "Innovations with environmental benefits" section from CIS 7 constitutes a loss, not least because it could provide useful indicators to tackle what Djellal and Gallouj (2010) define as

the *performance gap*. The latter is the distance which exists between actual performance and performance as measured by traditional economic tools (such as productivity growth), without taking into account other indirect effects (e.g. environmental friendly innovations).

As a provisional conclusion let us point out that in the European surveys there are explicit efforts in order to keep up with theory. One can see a parallel evolution of the questionnaires and of the theory, with the former trying to match the latter.

5. THE AMERICAN MEASUREMENT APPROACH: FROM SIRD TO BRDIS

The United States has a long tradition in carrying out applied studies along the line science, technology and innovation (STI). Vannevar Bush 1945 Report to the President of the United States is a milestone STI document on policy-making. Coming to the specific theme of our investigation, and closer to our time, we have to mention the 1968 and 1992 NBER studies coordinated by Fuchs and Griliches dedicated to the “The service economy” and to the “Output measurement in the service sectors”, respectively.

We have to point out from the outset that despite this well-established tradition, when we come to the analysis of innovation in services, the United States lags behind Europe in many respects, and specifically in the quality of surveys. This is surprising if we consider that early attention on services came from American studies – let us recall the 1960s works by Baumol, Fuchs and other American (or America-based) scholars.

The US National Science Foundation (NSF) began the first survey aimed at understanding innovativeness in manufacturing in 1953. This is the Survey of Industrial Research and Development (SIRD), which makes use of the questionnaire known as “Form RD-1”. As the label of the survey suggests, the focus was on R&D carried out in manufacturing firms: R&D was considered as *the* indicator, capable of synthesising innovativeness in firms. In the early years of the survey a small number of industries were surveyed among which there was also a catch-all category

called “non-manufacturing”. Some changes took place through time which culminated in 2009 in a partially renewed questionnaire called Business R&D *and Innovation* Survey (BRDIS).

Two important steps acknowledging the relevance of services took place in 1987 and 1998, respectively. In 1987 the NSF annual R&D Report began to send the SIRD questionnaire also to three broad non-manufacturing groups; they are: (1) communication, utility, engineering, architectural, research, development, testing, computer programming, and data-processing service industries; (2) hospitals; and (3) medical laboratories. In 1998, the number of service firms surveyed surpassed the manufacturing ones and, in 2007, about 53% of the 32,000 firms sampled belonged to non-manufacturing group³.

Let us emphasise that this acknowledgement did not lead to a new questionnaire – which ought to be capable of considering service-specific innovation dynamics: what happened was “simply” that the R&D-based questionnaire was sent to a broader sample of firms. A positive result, though, has been a clearer identification of service-sector R&D which according to Gallaher and colleagues, already in the late 1990s, weighted 37.8% of total US R&D expenditure (Gallaher *et al.*, 2005, p. 2-4).

Before showing the structure of the SIRD questionnaire, it is worth noting that from its inception in 1953 until 2007 – when the last SIRD was circulated – the survey has been constantly characterised by the *industrial research and development* features. Put it in another way, the core questions of the survey have been substantially unchanged over time (see also Hill, 2013). The structure of the last SIRD questionnaire is summarised in Table 2.

As one can see, the survey focuses on R&D performed within the single company; information is also gathered on R&D funded, but not performed, by the company itself.

Some problems emerge. The first concerns the use of Form RD-1 also for services, as it implies the assumption that the innovation process described by the R&D expenditure is the same in

³Non-manufacturing group involves: utilities; wholesale trade; retail trade; transportation and warehousing; information (which, in turn, involves publishing; telecommunications; internet service providers, web search portals, and data-processing services; other information); finance, insurance, and real estate; professional, scientific, and technical services; health care services; construction, mining, extraction and support activities, and other non-manufacturing.

manufacturing as in services (Gallaher and Petrusa 2006). Furthermore, the questionnaire concerns the input of innovation (R&D), but it does not investigate the output of the process of innovation, such as patents. Finally, despite the fact that non-manufacturing firms are more than half of the firms surveyed, the survey focuses only on R&D that is not the peculiar means through which services innovate. On the contrary, organisational innovations, which are often relevant for the service sector, are not considered at all.

TABLE 2: STRUCTURE OF THE 2007 SIRD QUESTIONNAIRE

Information about the company

- Was company owned by another company?
- Amount of sales, shipments, operating receipts, or revenues from domestic operations
- Number of employees in the 50 US or D.C.
- Number of full time equivalent scientists and engineers

R&D performed within the company

- cost by source (federal funds or company and other non-federal funds)
- federally funded R&D distinguished by Federal agencies
- cost for types of expenses (e.g. wages and salaries)
- cost for areas (biotechnology, software development, materials synthesis and processing, all other areas)
 - if the company perform any R&D using nanotechnology, what percentage of the cost for areas involves the use of nanotechnology
- cost of the R&D performed in each of the 50 US and D.C.
- projected cost for R&D in 2008

R&D funded but not performed by the company

- cost of R&D performed in the USA
- cost of R&D by types of organizations which are funded by the company

Cost for R&D that company performed within domestic collaborative arrangement

R&D funded by the company and performed outside the USA

- cost of the R&D funded by the company and performed by subsidiaries, affiliates or others based on the company's percentage of ownership
- cost of the R&D by foreign country

Cost of energy-related R&D by sources of energy

Further details on the information included in the report

- the report covers the entire consolidated domestic company?
 - Is the company publicly or privately owned?
 - Number of subsidiaries located in the USA included in the report
 - Number of subsidiaries located outside the USA included in the report
 - Percentage of the company owned by US companies
 - Percentage of the company owned by non-US companies
 - Information about reporting period, location of company's R&D records and data, contact information
-

In 2009 SIRD was replaced by the Business R&D and Innovation Survey (BRDIS) which was jointly developed by NSF and the US Census Bureau. The first BRDIS collected data for the calendar year 2008.

BRDIS is *still* primarily an R&D survey designed to better capture the changes that have occurred in the economy and in the way in which R&D is conducted in today's innovation- and global-based economies. In fact, while when the first SIRD took place in the 1950s the economy was manufacturing-based, today it is largely service-based. Furthermore, in the past R&D had primarily a domestic focus, it was conducted in company-owned central labs and it was funded mainly by government, while today it is much more dispersed, has a global focus and is often co-funded by the firm.

The new survey is annual and is sent to a representative sample of companies with 5 or more employees. Until 2011 it was conducted through two forms, BRDIS-1 and BRDIS-1A. The former was sent to companies with more than 3 million dollars in domestic R&D, while BRDIS-1A was sent to all other firms. Since 2012 two types of questionnaires have been circulated: BRDIS-1 is sent to the firms with *known* R&D activity, while all of the other firms get the BRD-1(S) questionnaire – which consists of an abridged version of BRDIS-1 (NSF 2015).

Next to core R&D expenditure questions – bound to create a connection with the time series provided by the previous SIRD rounds – a number of new questions have been introduced by BRDIS. The new questions concern: domestic and worldwide R&D relationships of the company (e.g. R&D agreements and R&D paid for by others), the strategic purpose of the worldwide R&D activities and their technology applications, intellectual property, technology transfer activities and innovative activities. With reference to intellectual property, BRDIS has overcome a SIRD gap; in the latter, in fact, the output of R&D activities was not investigated.

Among the novelties introduced by BRDIS, questions about innovation have been a priority of the industry survey redesign process. The reasons of the interest on innovation lie in the recognition of the key role played by innovation itself in the business strategy as well as in economic growth at

large. The results obtained by BRDIS represent the first national estimates of US innovation activity.

As one can see in Table 3, the first BRDIS included only one question on innovation aimed at understanding if, in the three-year period of reference, new or significantly improved goods, services, methods of manufacturing, logistics, delivery, distribution methods, or new support activities were introduced by the firm. More questions on innovation have been added in the subsequent surveys.

In the 2009 version of BRDIS two questions on the type of novelty and its economic weight were also included. The first question asked the firm to indicate whether the innovation(s) introduced was new to the market or just new to the company. The second question asked companies to indicate the percentage of their total annual sales from: goods or services new to the market and new to the company, and from goods and services that were unchanged or only marginally modified.

In 2010, besides the BRDIS-1 and -1A forms, another special experimental questionnaire, named BRDIS-1B, was used. Its experimental nature depended on the questions devoted to innovation that were structured as indicated in the second column of Table 3.

In 2011 two forms of BRDIS (1 and 1A) were used again, and both adopted the experimental version of the survey introduced in 2010. As it emerges from Table 3, the questions devoted to innovation in BRDIS-1B – which have been kept in the following versions of BRDIS circulated since 2012 – are substantially the same as those introduced in 2009, the main difference being the distinction between questions concerning product innovation and those referring to process innovation. In other words, the same questions which were proposed in 2009 are – in the experiment made in 2010 – divided into two groups, entitled respectively “product” and “process” innovation.

TABLE 3: QUESTIONS ABOUT INNOVATION IN BUSINESS R&D INNOVATION SURVEYS

Question (1) applicable to 2008 BRDIS-1 and -1A. For the 2009 and 2010 surveys, questions from (1) to (3) are applicable to both BRDIS-1 and -1A form.	Questions applicable to 2010 BRDIS-1B form, to 2011 BRDIS-1 and -1A, to 2012, 2013 BRDIS-1 and to 2014 BRDIS-1 and BRDIS-1(S).
<p>(1) Did your company introduce any of the following during the three years preceding the survey*?</p> <ul style="list-style-type: none"> a) New or significantly improved goods b) New or significantly improved services c) New or significantly improved methods of manufacturing or producing goods or services d) New or significantly improved logistics, delivery, or distribution methods e) New or significantly improved support activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing 	<p style="text-align: center;">PRODUCT (GOOD OR SERVICE) INNOVATION</p> <p>During the three years preceding the survey***, did the company introduce:</p> <ul style="list-style-type: none"> a) New or significantly improved goods? b) New or significantly improved services?
<p>(2) Were any of those new or significantly improved goods or services:</p> <ul style="list-style-type: none"> a) New to one of your markets? b) Only new to your company? 	<p>Were any of your product innovations during the three years preceding the survey:</p> <ul style="list-style-type: none"> a) New to market? b) New only to your company?
<p>(3) Give the percentage of your total sales in the year of reference of the survey** from:</p> <ul style="list-style-type: none"> a) New or significantly improved goods or services introduced during the three-year period investigated that were new to one of your markets b) New or significantly improved goods or services introduced during the three-year period investigated that were only new to your company c) Goods and services that were unchanged or only marginally modified during the three-year period investigated 	<p>Give the percentage of your total sales in the year of reference of the survey**** from:</p> <ul style="list-style-type: none"> a) New or significantly improved goods or services introduced during the three-year period investigated that were new to one of your markets b) New or significantly improved goods or services introduced during the three-year period investigated that were new only to your company c) Goods and services that were unchanged or only marginally modified during the three-year period investigated
<p><i>Notes:</i> * the three-year period investigated is: 2006-2008 for BRDIS-2008; 2007-2009 for BRDIS-2009; 2008-2010 for BRDIS-2010. ** the year of reference of the survey is 2009 for BRDIS-2009 and 2010 for BRDIS-2010. ***the three-year period investigated is: 2008-2010 for BRDIS-2010; 2009-2011 for BRDIS-2011; 2010-2012 for BRDIS-2012; 2011-2013 for BRDIS-2013; 2012-2014 for BRDIS-2014 . **** the year of reference of the survey is 2010 for BRDIS-2010 and 2011 for BRDIS-2011; 2012 for BRDIS-2012; 2013 for BRDIS-2013; 2014 for BRDIS-2014.</p>	<p style="text-align: center;">PROCESS INNOVATION</p> <p>During the three-year period investigated***, did your company introduce:</p> <ul style="list-style-type: none"> a) New or significantly improved methods of manufacturing or producing goods or services? b) New or significantly improved logistics, delivery or distribution methods for your inputs, goods, or services? c) New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing?

As one can see, some efforts have been carried out in order to broaden the concept of innovation. However, this broader concept remains locked in technological aspects – thus neglecting non-technological ones. Despite the improvements, the new survey is heavily affected by the manufacturing bias which characterised the previous surveys, so that innovation in services basically remains assimilated to innovation in manufacturing. Put in another way, BRDIS is still a subordinate survey.

6. COMPARISONS BETWEEN THE EUROPEAN AND THE AMERICAN APPROACH

Should one judge the European and the American approach to innovation, and to innovation in services specifically, on the basis of the large-scale surveys carried out in the two continents, one would get two different pictures. Obviously, innovation policies take into account many dimensions – just think of the defence-related origin of some radical innovations – and the surveys provide only one of the interlocking pieces of the jigsaw puzzle, and in this work we focus our attention on this piece, i.e. the surveys.

A first comment must be devoted to the content of the American SIRD. As we have seen in the previous section, SIRD was focused on R&D because the latter was considered as the indicator capable of synthesising the dimensions of innovation, the basic idea being that once we understand how, why and the way in which R&D is carried out, we also understand innovativeness. However, the fact that SIRD is qualitatively different from both the American BRDIS and the European CIS must be acknowledged.

The transition from SIRD to BRDIS could have lined up the American survey with the European one, but it did it only partially, missing, as we shall clarify in greater detail hereafter, the opportunity to consider explicitly services.

Worthy of a comment, before we go on with comparisons, is the fact that the experience of the American surveys finds little room both in the generalist and specialised journals while, on the other hand, the European CIS surveys get a lot of attention – incidentally, this is why in table 2 and 3 we

provide quite a few details on some specific questions contained in the SIRD and BRDIS questionnaires.

Let us now consider comparatively the European and American questionnaires in the light of the analysis provided in sections 4 and 5, bearing in mind the importance of the services component.

The evolution of the European CISs has led to a questionnaire in which organisational change, new marketing methods and ways to stimulate new ideas are explicitly considered. We can maintain that this is no longer a subordinate survey – as instead could be correctly classified a few years ago. The changes introduced have given rise to a new, third, type of survey which – in analogy to the theoretical typologies indicated above – can be indicated as *integrative* or *synthesis* survey. Put in another way, the evolution of the CIS questionnaire, despite having been originally conceived to study manufacturing innovation, lends itself to the study of – at least some – aspects of innovation in services. Furthermore, some features of manufacturing and service innovativeness overlap, and this can justify the circulation of the same questionnaire. Thus, it seems to us that the evolution of the European survey is in line with the economic debate.

In the USA the transition from SIRD to BRDIS has helped to overcome some of the gaps which characterised SIRD, but some crucial issues remain unsolved. Although BRDIS aims to be also an innovation survey, it has been basically locked in the R&D analysis. The latter situation may reflect the idea, which seems to permeate a lot of American publications concerned with science and technology policy – many published by the National Science Foundation – according to which R&D is *the* indicator which, in itself, is capable of synthesising everything else. In addition, we have to note that only product and process innovation are investigated while non-technological aspects of innovation are still neglected. Thus – despite the wide economic literature that stresses the role of non-technological innovation in a service-based economy – this kind of innovation remains out of the focus of the American survey. In particular, organisational innovations which are central in service firms are not considered. BRDIS belonged and *still* belongs to the *subordinate*

type. This is paradoxical when one considers that since 2009 non-manufacturing firms constitute 92% of the target population.

European scholars and the European Statistical Office have been more alert than the American counterparts in taking advantage from theoretical and applied developments. This does not mean that the European surveys are fully satisfactory. The inclusion, subsequent exclusion and, sometimes, reintroduction of some questions creates some confusion: this is the case of environmental issues, creativity and skills, and trademarks. The reason behind this choice may be the response rate of the firms which may find it difficult to provide an answer (particularly on the first two items). However, despite this criticism, one can see improvements which represent a clear step from subordinate to integrative surveys, that is from the assimilation to the integrative approach. European surveys have actually helped to better understand innovativeness of service firms, thus reducing the innovation gap, that is that part of innovation which escaped traditional measurement.

Sometimes differences between questionnaires seem trivial, but even questions to which one can reply only “yes” or “no” provide important information. For instance, as we pointed out in section 4 above, in CIS 3 a section on “strategic and organisational change” was introduced. It was articulated into five questions to which respondents could only answer yes or no, and yet one gets to know important aspects on the type of novelties introduced by the firm. Furthermore, this early structure has been improved, leading to two sections concerned with organisational and marketing innovations respectively, in CIS 6.

The differences between the European and the American approach appear even more striking when one considers the fact that both entities are member of the Oecd, and that the latter organisation has developed a common ground to collect and interpret innovation data by means of three different editions of the Oslo Manual.

7. CONCLUSIONS

First of all it is surprising that the main theoretical improvements on innovation in services which took place in the 1990s are due to European scholars. In fact, American scholars were quicker than European ones in understanding the importance of this new stage of economic development, both in quantitative and qualitative terms. The early extensive study by the NBER led by V.R. Fuchs (1968), together with his and other American scholars' 1960s works, should have provided the ground on which an America primacy could have been established – but this was not the case.

Second, in hindsight, the fact that the “innovation in services” research line emerged as late as in the 1990s is also surprising: by the mid-1960s tertiary employment exceeded 50% of total employment in most of the world leading economies, and this phenomenon was read through Baumol's cost disease theory for a long time – employment in services expands *because* the tertiary sectors are characterised by low productivity and scarce innovativeness (Baumol 1967; Baumol and Bowen 1966).

In the 1990s it became clear that something was missing in the economics of innovation, and during the decade a crescendo of studies tackled the issues of definitions and measurement at both theoretical and applied level. Theory and data gathering have developed through explicit efforts, sometimes in a co-ordinated way, sometimes not. About theory, three approaches have dominated thus far the scene, i.e. the *assimilation*, the *service-oriented* and the *integrative* (or *synthesis*) approach. On the applied side, when we refer to surveys aimed at providing data for the understanding of innovativeness, two types of surveys have been identified, namely *subordinate* and *autonomous* surveys.

While the theoretical side is covered in abundance by existing works, the features of the questionnaires on which the surveys are based have not been widely investigated. Incidentally, it is worth underlining that while in the literature one always finds comments related to the European CISs, the role played by the American SIRD / BRDIS is often neglected.

Significant theoretical developments on innovation in services have occurred since Barras' seminal paper (Barras 1986a), and theory has helped to develop operational guidelines – such as the ones contained in the Oslo Manuals – as well as in devising questionnaires.

When we come to the questionnaires, however, one immediately realises that to conceive of questions aimed at extracting information on sometimes impalpable forms of innovation is not an easy task. The problem is particularly strong when we try to consider services as one sector, which thus contains the most and the least advanced sub-sectors, ranging from high-level consultancy to hairdressers. Put it in another way it is very difficult to think of an “ideal” questionnaire.

As we have illustrated in the previous sections, the European CIS has been explicitly developed in order to capture some dimensions which concern innovativeness in services: in particular, the questions introduced in the third CIS round, further refined in the sixth, provide ground to get information on those non-technological forms of innovation which are important in services. This is why we can maintain that this is no longer a subordinate survey. On the other hand, the American BRDIS, which represents the evolution of SIRD in the direction of explicitly surveying innovativeness, still focuses exclusively on technological forms of innovation, thus keeping it under the “subordinate” label.

Before providing some more comments on further developments concerning CIS let us clarify what follows. Large-scale surveys are one source of information providing ground for policy action. Policy makers, however, react also to other stimuli, and thus can implement policies taking more or less into account the surveys' results. Furthermore, better questionnaires do not automatically mean better policies: if policy has any effect at all, judging from American and European performance in terms of innovativeness of service firms, the former has been much more successful than the latter in the last few decades. What we are saying is thus that the *potential* offered by the European questionnaire is higher than the potential provided by the American questionnaire. How much of that potential is translated into real capacity through policy is a different matter.

This having been clarified, let us propose two final comments on CIS questionnaires' development. First of all the European survey needs to be pushed more convincingly on the path of the integrative approach: the changes introduced in the latest rounds point in the right direction, but more could be done. What has taken place in the recent past has been incremental change rather than proper reshaping of the questionnaires: it would be useful to design innovation surveys on the basis of the integrative approach, highlighting the interplay between technological and non-technological aspects of innovation, setting goods and services on the same level.

Finally, we suggest a further indicator which could be included in the questionnaires, useful to understand innovativeness in both services and manufacturing: *quality certification*. Quality is defined as “the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs” (Barker 1994). Almost invariably quality certification, while it is being attained, leads to improvements in the products, processes and services under scrutiny. We are aware of the fact that one runs the risk of watering down the concept of innovation, but, particularly when we deal with services, the quest for indicators may take elusive roads.

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