

# IDEA paper

IDEA PAPER SERIES

IDEA  
7  
1998

**INNOVATION IN THE  
SERVICE SECTOR**  
*Results from the  
Italian statistical survey*

**Rinaldo Evangelista  
and Giorgio Sirilli**

*Rinaldo Evangelista, Ph.D., is a Researcher at the Institute for Studies on Scientific Research and Documentation of the National Research Council of Italy (Cnr-Isrds). Giorgio Sirilli is Research Director at the Institute for Studies on Scientific Research and Documentation of the National Research Council of Italy (Cnr-Isrds), and Professor of Industrial Economics at the LUISS University of Rome. Address correspondence to Dr. Rinaldo Evangelista, Cnr-Isrds, Via C. De Lollis 12, 00185 Rome, Italy. Tel.: +39-6-44879260; Fax: +39-6-4463836; E-mail: evangeli@isrds.rm.cnr.it*

*The authors are grateful to Mario Pianta and Daniele Archibugi for comments and to Leopoldo Nascia for his help in the elaboration of data and preparation of the statistical material*

**STEP**  
group

Studies in technology, innovation and economic policy  
Studier i teknologi, innovasjon og økonomisk politikk

# IDEA

This report is part of Sub-Project 2.1, ‘Innovation Indicators for the Service Sector’, of the IDEA (Indicators and Data for European Analysis) Project. IDEA is Project No. PL951005 under the Targeted Socio-Economic Research Programme, Area 1 (Evaluation of Science and Technology Policy Options in Europe), Theme 1.3: *Methodologies, Tools and Approaches Relevant for the Preparation, Monitoring and Evaluation of Science and Technology Policies*.

An overview of the project as a whole, covering objectives, work programme, and results, including downloadable reports, can be found on the IDEA Web-site:

<http://www.sol.no/step/IDEA/>

## ABSTRACT

This paper provides fresh empirical evidence on the relevance and nature of innovation activities in the service sector.

Technological innovation is quite a diffused phenomenon in market services: more than one third of surveyed firms have introduced technological innovations during the period 1993-95.

The amount of financial resources devoted to innovation varies widely across service sectors. Financial, computing and software, engineering, and telecommunication services are the most innovative service sectors.

Most service firms can distinguish between innovations in services and in processes. Process innovation emerges as the most diffused typology.

Service firms rely on a wide range of innovation sources. The acquisition and development of software and investment in machinery are the most cited. Investment, R&D and software are the major components of firms' innovation expenditure. Major obstacles for introducing technological innovation are of an economic nature - i.e. cost and risk too high. The two most important objectives of firms' innovation strategies consist of improving service quality and reducing cost.

Technological information is drawn mainly from in-house production departments as well as from outside suppliers of equipment, materials and components. Public and private research institutions as well as patents and licences play a very marginal role.

Finally, in the near future the importance of technology for firms' performance is expected to increase in service industries.

## TABLE OF CONTENTS

<b>ABSTRACT</b> .....	<b>II</b>
<b>TABLE OF CONTENTS</b> .....	<b>III</b>
<b>TABLES</b> .....	<b>III</b>
<b>INTRODUCTION</b> .....	<b>1</b>
<b>MEASURING INNOVATION ACTIVITIES IN SERVICES: CONCEPTUAL ISSUES AND METHODOLOGY</b> .....	<b>3</b>
<b>SURVEY RESULTS</b> .....	<b>5</b>
<i>Relevance of innovation in the service sector</i> .....	5
<i>Product and process innovations in service sector</i> .....	7
<i>Sources of innovation in services</i> .....	9
<i>Sources of information for innovation</i> .....	13
<i>Objectives of the innovations</i> .....	14
<i>Obstacles to innovation</i> .....	15
<i>The importance of technology for firms' performance</i> .....	16
<b>CONCLUSIONS</b> .....	<b>18</b>
<b>REFERENCES</b> .....	<b>20</b>
<b>APPENDIX</b> .....	<b>22</b>

## TABLES

<i>Table 1: Innovating and non-innovating firms by industry and firm size</i> .....	6
<i>Table 2: Innovating firms by type of innovation introduced (% values)</i> .....	8
<i>Table 3: Innovating firms by type of innovation activity performed (percentage of firms which have spent money for the various activities).</i> .....	10
<i>Table 4: Breakdown of innovation costs and innovative intensity by industry (percent values)</i> .....	12
<i>Table 5: Sources of information for innovation</i> .....	14
<i>Table 6: Objectives of innovation</i> .....	15
<i>Table 7: Factors hampering innovation</i> .....	16
<i>Table 8: Importance of technology for firms' performance (% of firms)</i> .....	17

## INTRODUCTION

The service sector is nowadays a major component of modern advanced countries: in 1992 private and public services accounted for almost two thirds of jobs in most of the OECD countries. This is the result of a historical process which has seen a progressive shift of employment first from agriculture to manufacturing and then from manufacturing to service activities. Among the private service sectors, the more dynamic components over the last 20 years have been financial and business services along with community, social and personal services [1].

The continuous proliferation of new services, and the processes of commoditisation, industrialisation and reorganisation of services on a global scale, suggest that services are at the core of current structural changes in modern economies.

Technology and innovation activities represent major forces behind such structural processes, with information and communication technologies playing a pivotal role in revolutionising the ways most of "traditional" services are produced, traded and delivered as well as offering opportunities for the generation of new ones in a variety of service industries. This already suggests that the old view according to which service industries are technologically backward could be misleading. An increasing amount of empirical evidence is showing that this is the case. Recent OECD estimates show that service industries now perform in most countries almost a fourth of total business R&D (24.8% in 1991 compared to a share of 4.2% in 1981)<sup>1</sup>. Also with respect to the adoption and diffusion of new technologies, the service sector does not seem to be backward relatively to manufacturing. Service industries are heavy users of information technologies, and the bulk of information technology investment is actually used by services - around 80% in the UK and USA, with financial and communications services being the major technology adopters within services [2]. Furthermore, recent studies show that services are the industries which have benefited most (in terms of productivity gains) from the use of technologies embodied in new capital goods [3]. There is also increasing evidence that service sectors heavily invest in human resources, which are increasingly recognised as a key competitive element of firms' innovative strategies.

---

<sup>1</sup> It is still not clear, however, how much of this increase is due to the changes in the categorisation of the same firms from manufacturing to services and to the coverage of R&D statistics, and the extent to which it is due to a real increase of the R&D innovative efforts of service firms.

We are however a long way from having a satisfactory picture of the extent, role and nature of innovative activities in the service sector, the statistical data presently available on technology and innovation in services being still inadequate to represent the highly diversified universe of service activities. In the last two decades much of the theoretical and empirical literature on technology and innovation has in fact been focused on manufacturing. With respect to this sector we have learned a great deal about how innovation activities take place, their inducement factors, and major differences in the technological patterns across main typologies of industries and firms. Following the methodological framework and guidelines set out in the 1989 OECD “Oslo Manual” [4], in the last few years innovation surveys have significantly contributed to achieve a more comprehensive picture of the nature of innovation activities in manufacturing within a wider exercise of developing and refining science and technology indicators [5]<sup>2</sup>.

Only very recently some attempts to extend the use of innovation surveys from manufacturing to the service sector have been made. The evidence collected so far is however highly diverse and not comparable, due to the lack of standardisation of concepts and statistical methodologies used in the different countries. In some studies the methodology adopted for the manufacturing sector has been used without major adaptations [8], while in others innovation has been to differing degrees linked to technological and organisational changes [9]. A convergence process has however been started in the 1990’s, with OECD and EUROSTAT playing a major role in promoting the development and use of common definitions and statistical procedures [10]<sup>3</sup>.

This paper is intended to contribute to this international endeavour by providing new empirical evidence gathered through the innovation survey carried out in Italy by the National Statistical Office (ISTAT) in collaboration with the Institute for Studies on Scientific Research and Documentation of the National Research Council. The methodology used is described in the Appendix. This survey represents the first large-scale statistical attempt to collect systematic information on innovation activities in the service sector on the basis of the guidelines indicated in the revised

---

<sup>2</sup> The underlying model of innovation has been basically the “chain-linked” model, which looks at R&D as one of the driving forces of the process [6], and at innovation as a multifaceted phenomenon which takes place within the “national systems of innovation” which include firms, government laboratories, regulatory agencies, universities, funding organisations, the government [7].

<sup>3</sup>The methodologies used in the surveys and some analytical results are set out in various publications,[11][12];

OECD “Oslo Manual” [13].<sup>4</sup> In particular, the richness of the Italian data-base resides in the size and representativeness of the sample which covers 3,258 firms in market services (retail trade, wholesale trade, hotels and restaurants, transport, communication, finance and insurance, property and business services, waste disposal) which have introduced innovations in the period 1993-1995. The sample was drawn from market service companies (public services are excluded) with more than 20 employees. The results of the survey allow us for the first time to get a broad picture of firms' innovation strategies and performances in the service sector, looking at the type of innovation introduced (service/process), type of innovation inputs (R&D, design, software, training, investment, marketing), the sources of information used for innovating, objectives of innovation (efficiency, quality enhancing), obstacles in introducing innovations.

This paper is structured in three major sections. The first section addresses some conceptual and methodological issues in the measurement of innovation in the service sector, clarifying the methodological approach adopted by the Italian innovation survey. The next section analyses the results of the survey. The last section summarises the empirical findings. The Appendix, prepared by Aldo Del Santo and Giulio Perani of ISTAT, sets forth the statistical methodology of the survey.

## **MEASURING INNOVATION ACTIVITIES IN SERVICES: CONCEPTUAL ISSUES AND METHODOLOGY**

The necessity to carry out a systematic data collection on innovation activities in the service sector is nowadays widely recognised. International statistical organisations, such as OECD and EUROSTAT as well as national statistical offices, have only recently started to move the first steps in the direction of improving definitions, classifications and the statistical procedures for the collection of reliable and comparable data on technology and innovation in the service sector [14]. As far as R&D statistics are concerned, significant steps ahead have been done in terms of actual coverage and collection of data.

The experience accumulated in measuring innovation in the manufacturing sector represents a very good starting point for measuring innovation in services [15]. However, the question of whether and to what extent the methodological and

---

<sup>4</sup> There are some differences between the definitions used in this survey and those of the “Oslo Manual” because when the survey questionnaire was prepared the 1997 version of the Manual was not available.

conceptual framework developed over the last decades with reference to manufacturing activities can be used for analysing and measuring innovation activities in the service sector should also be addressed.

In the last years several contributions have identified a few distinctive features of services which are thought to bear important implications for innovation. Even though a general consensus on the basic features of services is lacking, some aspects are commonly recalled in the literature:

- a close interaction between production and consumption (co-terminality);
- a high information-intangible content of services products and processes;
- an increasing role played by human resources as a key competitive factor;
- a critical role played by organisational factors for firms' performance<sup>5</sup>.

These four characteristics are thought to have direct implications for the conceptualisation and definition of innovation. Among the most important we can identify the following.

The co-terminality between production and consumption in the service sector makes the distinction between product and process innovations less clear-cut when compared to the ones used for the manufacturing sector. Miles has introduced a new typology of innovations, i.e. delivery innovation, in order to take into account the "delivery nature" of many service activities [17] [18] .

Furthermore, due to the close interface between production and consumption of services, a large part of innovation activities in the service sectors is oriented to the adaptation-customisation of the services to the user's needs, which might be thought as "innovative" though incorporating a limited technological content.

The intangible nature and the information-based characteristics of "production and delivery processes" and output of services give to information technologies a central role in firms' innovation activities. This suggests that the generation and diffusion of information technologies should clearly be included in both the definition of innovation and its expenditures.

---

<sup>5</sup> Miles identifies additional peculiar characteristics of the products, processes, organisations and markets of services, namely low levels of capital equipment, non continuous nature of production processes, key role played by the process of delivery of the services, limited role played by economies of scale, high regulated regimes of markets and products [16]. The features identified by Miles contain, however, a high degree of generalisation which contrasts with the heterogeneous nature of the service sector.

The important role played by the human factor in the organisation and delivery of services is associated with substantial investment in human resources. Despite the fact that training activities are not usually considered as innovative inputs, they could explicitly be regarded as one of the main channels to upgrade the technological capabilities of firms in the service sector.

Finally, the importance of the organisational factor in the service sector raises the issue of an enlargement of the concept of innovation in order to include organisational changes which can either be linked to, or be independent from, the introduction of technological innovations. Other types of knowledge, know-how and capabilities might also be important to explain firms' performances and represent an important part of firms' strategies.

The Italian survey, following the guidelines contained in the revised OECD "Oslo Manual", focuses on technological innovation, while activities of customisation and organisational changes have not been taken into account. It is believed, in fact, that much more work needs to be done in order to strengthen the theoretical, conceptual and definitional basis of the so called "peculiarities" of innovation in services before the latter become amenable to statistical measurement. The questionnaire used in the Italian innovation survey has been designed in order to investigate at least some of the most debated issues raised in the literature. In particular, specific questions have been included on the relative importance of software in firms' innovation expenditures, on the usefulness of maintaining the distinction of product and process innovation, on the relative importance of technology vis-à-vis other factors in explaining the economic performance, on the impact of innovation on employment.

## **SURVEY RESULTS**

### **Relevance of innovation in the service sector**

Table 1 shows that a little more than one third of surveyed firms (36.9%) have introduced technological innovations over the period 1993-1995.<sup>6</sup> There are significant differences in the percentage of innovating firms across sectors: in R&D,

---

<sup>6</sup>This figure is quite similar to that of manufacturing: according to the ISTAT survey, 33% of Italian manufacturing firms introduced product or process innovations in the period 1990-1992 [19]. At the present stage, the comparison of average figures for the manufacturing and the service sectors should be interpreted with some caution due to the fact that data on services are still provisional. However, the final data are expected not to be significantly different from those reported in this paper.

banking, insurance, the percentage is 70% or over; in retail trade, hotels and restaurants, cleaning and security innovative firms are around one fifth.

*Table 1: Innovating and non-innovating firms by industry and firm size*

	Total firms (*)	% Innovating firms on total firms
<b>Service sectors</b>		
Trade and repair of motorvehicles	111	28,8
Wholesale trade (excl. motorvehicles)	409	34,2
Retail trade	216	24,5
Hotel and Restaurants	193	20,7
Land transportation	205	38,0
Shipping and sea transportation	19	47,4
Travel and transport services	147	34,7
Post and telecommunication	10	20,0
Banking	198	71,7
Insurance	40	70,0
Other financial	21	57,1
Computing and software	86	59,3
R&D	17	88,2
Legal, Accounting	50	32,0
Engineering	39	48,7
Advertising	12	58,3
Cleaning and security	186	18,8
Business services	41	26,8
Waste disposal	34	44,1
<b>Total</b>	<b>2035</b>	<b>37,1</b>
<b>Classes of employees</b>		
20-49	1167	26,6
50-99	253	35,6
100-199	140	40,0
200-499	324	52,5
500-999	90	76,7
1000 and over	82	75,6
<b>Total</b>	<b>2056</b>	<b>36,9</b>

(\*) The two totals are different due to the exclusion of service sectors with less than 3 firms

Table 1 also shows a positive relationship between the share of innovating firms and their size: the percentage increases from 26.6% for firms with a number of employees between 20 and 49 to 75.6% for firms with more than 1000 employees. This pattern may be explained, at least in part, by the scale of service activities: large firms are more likely to report that they have introduced innovations as they typically have a broader range of products and lines of business.

The data shown in table 1 are consistent with some studies carried out in other countries (Australia and Netherlands) which, even not fully comparable, show on the one hand that the number of innovating firms varies between one third and one

fourth of the total, and that the intensity of innovation varies widely across industries and increases with firm size [8] [20] .

### **Product and process innovations in service sector**

The distinction between product and process is deemed to be very relevant in the analysis of innovative phenomena, in particular with reference to the role of innovation in the creation of new markets and the impact on employment; the methodological problem is to assess to what extent this analytical distinction is applicable and amenable to statistical measurement in the service sector.

Surveyed firms have been asked to specify the type of innovation introduced, distinguishing between product and process/delivery innovation. Firms have also been given the option to indicate whether they had introduced innovations for which the distinction between product and process was not applicable.

Table 2 shows that 64.6% of firms have introduced either a product or process/delivery innovation or both, 23.6% have not been able to distinguish between the two (even though they have introduced innovations) and the remaining 10.8% have both introduced service or process innovations and, at the same time, have found difficult to separate between the two.

Table 2: *Innovating firms by type of innovation introduced (% values)*

Service sectors	Total innovating firms (*)	% of firms introducing service innovation only	% of firms introducing process innovation only	% of firms introducing service and process innovation	% of firms declaring the distinction not applicable	
					in any case	only in some cases
Trade of motorvehicles	32	12,5	46,9	6,3	34,4	0,0
Wholesale (excl. motorvehicles)	140	17,1	32,9	12,9	27,9	9,3
Retail trade	53	20,8	35,8	11,3	24,5	7,5
Hotel and Restaurants	40	22,5	17,5	7,5	47,5	5,0
Land, shipping and sea transportation	87	25,3	35,6	14,9	11,5	12,6
Supporting services for transportation	51	13,7	43,1	7,8	25,5	9,8
Financial (excl. insurance)	142	8,5	21,1	34,5	14,1	21,8
Insurance	28	3,6	32,1	21,4	28,6	14,3
Financial intermediation	12	0,0	41,7	8,3	33,3	16,7
Informatics	51	9,8	25,5	41,2	15,7	7,8
R&D	15	6,7	0,0	46,7	26,7	20,0
Legal, Accounting	16	12,5	37,5	12,5	31,3	6,3
Engineering	19	21,1	31,6	21,1	21,1	5,3
Cleaning and security	35	22,9	17,1	22,9	37,1	0,0
Other	18	22,2	27,8	22,2	27,8	0,0
Waste disposal	15	20,0	60,0	6,7	13,3	0,0
<b>Total</b>	<b>754</b>	<b>15,5</b>	<b>30,4</b>	<b>19,8</b>	<b>23,6</b>	<b>10,7</b>
<b>Classes of employees</b>						
20-49	311	18,3	33,1	12,9	29,3	6,4
50-99	90	22,2	26,7	16,7	27,8	6,7
100-199	56	10,7	35,7	17,9	26,8	8,9
200-499	170	14,7	30,6	27,1	18,2	9,4
500-999	69	5,8	24,6	27,5	15,9	26,1
1000 and over	62	8,1	24,2	30,6	9,7	27,4
<b>Total</b>	<b>758</b>	<b>15,4</b>	<b>30,5</b>	<b>19,7</b>	<b>23,6</b>	<b>10,8</b>

(\*) The two totals are different due to the exclusion of service sectors with less than 12 firms

The data suggest that the majority of innovations introduced by Italian service firms in the period 1993-1995 are process or delivery innovations, which have been introduced either alone (30.5% of firms) or in connection with new services.

From a statistical point of view, the fact that only one fourth of firms has not been able to split their innovations supports the thesis that, overall, the distinction between service and process innovation is viable at the firm's level and reliable data can be collected. This result is important as a large part of the literature stresses the intimate linkage between the two and the practical impossibility in services to single out new services and new production and delivery processes. However, the data also show that there are indeed service sectors where the distinction between service and process innovation is more problematic. This is the case of restaurants and hotels (where 47.5% of innovating firms have not been able to distinguish between product and process innovation), cleaning and security (37.1%), trade and repair of motor vehicles (34.4%). In all these cases additional efforts should be made in order to

develop a methodology which can make it easier for respondents to distinguish between product and process innovation. A practical suggestion might be to stress the different economic objectives which underline the introduction of product and process innovations. The emphasis could be put on the distinction between the innovations introduced with the aim of creating new markets (i.e. service innovations) and the introduction of new production and delivery processes which allow firms to be more competitive from the cost side (i.e. process innovations). The results of a pilot survey conducted in Italy in 1995 by the authors of this article has shown that if such "economic criteria" is made explicit most service firms are able to distinguish between product and process innovations [10].<sup>7</sup>

### **Sources of innovation in services**

The multiform nature of innovative activities and their sectoral specificity have been underlined by a vast literature, especially with reference to the manufacturing sector [12]. Besides activities generating new technological knowledge such as R&D, special attention has also been attached to processes of technology adoption and diffusion [21] [22]. The linear model of innovation centered on R&D has been superseded by one envisaging the existence of a wider variety of technological sources (both internal and external to the firm) and feed-backs between the different stages and agents involved in the innovation process (chain-linked model) [6]. The "Oslo Manual" adopts this more comprehensive perspective of innovation activities and identifies for the service sector various innovative activities: R&D, design, the acquisition of know-how, the acquisition and development of new software, training activities necessary to introduce innovations and the purchase of new equipment and machinery.

The relative importance of the various types of innovative sources can be assessed by looking at the actual involvement of firms in such activities and at the associated expenditure. Table 3, which provides for the year 1995 data on the percentage of innovating firms performing the different activities, shows that firms rely on a wide range of innovative activities, often simultaneously. The two most frequent activities are acquisition and development of software and investment in new machinery and

---

<sup>7</sup> The fact that economic criteria can be used in order to distinguish between products and process has emerged during the interviews carried out by the authors: firms clearly identified two main dimensions of the innovative process, those aimed at increasing the overall efficiency of the firm (i.e. management control, devices enhancing the general performance of telecommunication and electronic networks, accounting procedures, back office automation, etc.), and those consisting of the introduction of new services characterised mainly by their enhanced performances. The survey has also shown that in many service industries process innovations represent the most important part of firms' innovative efforts.

equipment with percentages of firms performing such activities higher than 70%. The key role played by investment in machinery and equipment had already emerged from innovation surveys in the manufacturing sector [15] [23]. It also confirms more recent studies which have found services as major users of embodied technologies [3]. The widespread diffusion of software activities is quite striking. Furthermore, the magnitude of such figure suggests that this is probably not only a peculiar feature of innovation process in services, but it is likely to be relevant also to most manufacturing industries.<sup>8</sup>

*Table 3: Innovating firms by type of innovation activity performed (percentage of firms which have spent money for the various activities).*

<b>Service sectors</b>	Total innovating firms (*)	R&D	Design	Acquisition of know-how	Software	Training	Marketing	Innovative investment
Trade and repair of motorvehicles	24	0,0	8,3	0,0	75,0	16,7	12,5	54,2
Wholesale trade (excl. motorvehicles)	108	13,0	18,5	15,7	66,7	29,6	12,0	79,6
Retail trade	38	15,8	21,1	23,7	68,4	34,2	13,2	71,1
Hotel and Restaurants	26	15,4	15,4	11,5	57,7	19,2	23,1	53,8
Transport (excl. air)	67	14,5	21,7	20,3	62,3	34,8	13,0	78,3
Travel and transport services	44	18,2	18,2	13,6	70,5	29,5	11,4	72,7
Banking	99	30,3	57,6	38,4	88,9	67,7	34,3	74,7
Insurance	24	54,2	66,7	54,2	87,5	66,7	20,8	70,8
Other financial	12	16,7	25,0	8,3	91,7	41,7	8,3	41,7
Computing and software	38	44,7	68,4	34,2	68,4	60,5	23,7	60,5
R&D	11	72,7	54,5	45,5	63,6	72,7	18,2	72,7
Legal, Accounting	11	27,3	36,4	9,1	72,7	72,7	9,1	72,7
Engineering	17	70,6	52,9	35,3	76,5	47,1	29,4	64,7
Cleaning and security	26	7,7	11,5	11,5	76,9	42,3	11,5	73,1
Business services and advert.	13	7,7	38,5	7,7	69,2	30,8	38,5	61,5
Waste disposal	12	16,7	41,7	0,0	41,7	25,0	16,7	75,0
<b>Total</b>	<b>572</b>	<b>23,1</b>	<b>33,4</b>	<b>22,7</b>	<b>72,2</b>	<b>42,7</b>	<b>18,9</b>	<b>71,3</b>
<b>Classes of employees</b>								
20-49	236	12,7	17,8	12,3	69,1	30,9	11,0	69,5
50-99	67	17,9	25,4	23,9	67,2	32,8	9,0	64,2
100-199	44	27,3	38,6	20,5	63,6	47,7	25,0	75,0
200-499	126	29,4	37,3	28,6	74,6	48,4	25,4	73,8
500-999	52	32,7	59,6	40,4	80,8	67,3	32,7	69,2
1000 and over	49	51,0	77,6	40,8	87,8	67,3	34,7	83,7
<b>Total</b>	<b>574</b>	<b>23,2</b>	<b>33,4</b>	<b>22,8</b>	<b>72,3</b>	<b>42,7</b>	<b>19,0</b>	<b>71,4</b>

(\*) The two totals are different due to the exclusion of service sectors with less than 12 firms

Conversely, R&D, acquisition of know-how and marketing emerge as much less frequent innovation activities (23.2% of innovating firms perform R&D, 22.8%

<sup>8</sup> Unfortunately, innovation surveys in the manufacturing sectors have not explicitly covered software activities. Also the revised version of the "Oslo Manual" does not suggest the inclusion software among the different innovation cost items in the questionnaires. This will mean that no comparison will be possible on the relative importance of software between service and manufacturing sectors.

acquire technological know-how and 19.0% of innovating firms carry out marketing activities linked to the introduction of new services). Training activities related to the introduction of technological innovation and design have been carried out by 42.7% and 33.4% of innovating firms respectively.

Table 3 also shows that large firms use, in a complementary way, a broader range of innovative sources than small firms. The percentage of firms performing each of innovative activity listed in the table increases with firm size. In particular, more than two thirds of firms with more than 1000 employees perform innovation activities such as software development (87.8%), investment (83.7%) design (77.6%) and training (67.3%) and more than half of the firms in the same size class perform R&D activities (51.0%).

Table 4 shows for the service sector as a whole and for the different service industries the distribution of firms' expenditures among the different innovation activities; here a picture somewhat different from the previous one emerges. Also in this case investment is the most important component of innovation, representing 46.2% of total innovation expenditure in the service sector. Software activities, despite being carried out by the majority of service innovating firms, represent only 15.0% of total innovation expenditure, less than the share devoted to R&D activities (24.5%). The other components of innovation expenditure (design, acquisition of know-how and marketing) play a relatively minor role, covering all together less than 13% of total innovation expenditure.

Table 4: Breakdown of innovation costs and innovative intensity by industry (percent values)

Service sectors	R&D	design	know-how	software	training	marketing	investment	Totals	(Mln of lire)
Trade and repair of motorvehicles	0,0	6,7	0,0	49,1	2,6	1,4	40,2	100,0	3,1
Wholesale trade (ex. motorvehicles)	3,1	2,8	2,2	16,4	1,7	2,2	71,7	100,0	7,8
Retail trade	1,9	11,7	6,0	27,6	2,1	11,9	38,8	100,0	0,9
Hotel and Restaurants	5,0	4,5	2,1	27,4	3,8	20,0	37,2	100,0	1,8
Transport (excl. air)	0,6	3,7	1,8	6,2	1,2	3,4	83,1	100,0	3,3
Travel and transport services	2,4	5,6	0,6	17,5	1,4	0,4	72,2	100,0	3,7
Post and telecommunication	24,2	0,6	1,5	5,5	0,0	4,3	64,0	100,0	9,3
Banking	2,1	10,0	7,4	42,2	2,7	1,3	34,3	100,0	4,7
Insurance	7,2	20,5	5,7	30,9	5,3	0,3	30,0	100,0	6,0
Other financial	0,3	2,6	0,1	18,7	0,7	0,2	77,3	100,0	29,7
Computing and software	20,1	26,6	7,3	9,0	4,0	1,2	31,7	100,0	14,8
R&D	72,3	9,1	1,3	1,1	1,0	0,2	15,0	100,0	140,4
Legal, Accounting	7,5	22,6	14,7	14,5	8,3	0,1	32,3	100,0	2,9
Engineering	71,4	8,4	0,8	5,6	2,6	0,6	10,6	100,0	13,1
Cleaning and security	3,9	1,4	5,8	26,9	6,7	3,9	51,6	100,0	0,4
Business services and advert.	2,1	12,6	1,1	55,2	1,9	5,1	22,1	100,0	6,6
Waste disposal	0,1	4,8	0,0	2,3	0,4	0,8	91,5	100,0	4,1
<b>Total</b>	<b>24,5</b>	<b>7,3</b>	<b>3,2</b>	<b>15,0</b>	<b>1,5</b>	<b>2,3</b>	<b>46,2</b>	<b>100,0</b>	<b>6,9</b>

Table 4 allows also to look at the relative importance of the different sources of innovation across industries. Service industries for which R&D plays an important role are high-tech service industries such as research and development (72.3% of total innovation costs), engineering services (71.4%), post and telecommunications (24.2%), computer and software (20.1%). Industries which devote substantial shares of their innovation expenditure to software are business services and advertising (55.2%), trade and repair of motor-vehicles (49.1%), banking (42.2%), insurance (30.9%). Industries innovating mainly through the acquisition of new machinery and equipment are waste disposal (91.5%), transport (83.1%) and other financial services (77.3%). Overall, investment represents a large chunk of innovation expenditure across most industries. Hotels and restaurants, and retail trade, devote to marketing above average shares of innovation expenditure. Computer and software services, legal and accountancy services, and insurance stress the importance of the design component. Training activities are important for legal and accountancy services, cleaning and security, computer and software services, and insurance. Finally, acquisition of know-how is more relevant in legal and accountancy services, financial services, retail trade and insurance.

An indicator of innovation intensity, i.e. the total innovation expenditure per employee by sector is also reported in the last column of Table 4: data show that market service firms spent in 1995 on average 6.9 million Lire (the equivalent of \$

4,500) per employee.<sup>9</sup> Other financial services, computing and software, engineering services and post and telecommunications show an innovation intensity above the service sector average (spending on innovation an amount between 9 and 30 million Lire per employee). Among the sectors which spend less on innovation are security and cleaning, retail trade and hotels and restaurants.

Overall, data on innovation expenditure show that a wide variety of innovative sectoral patterns exist across service sectors both in terms of activities involved in the introduction of innovations and of the amount of financial effort devoted to innovation.

### **Sources of information for innovation**

In the survey questionnaire the sources of information for innovation have been distinguished between "internal" and "external" to the firm. Firms were asked to provide an assessment of the importance of the different sources attaching them a score between 0 (in the case the source was not relevant) to 5 in case it was deemed crucial.

Table 5 shows a list of information sources ranked according to their importance measured in terms of percentage of firms which have judged each source as "relevant" (scores 4 or 5). The most important sources are the firm's production and delivery departments (69.5%) and outside suppliers of equipment, materials and components (76.9%). Conferences, seminars, specialised journals, consultancy firms and competitors are perceived as "relevant" by more than 60% of firms. It is interesting to note that customers do not rank particularly high in the list; this is in contrast with most of the literature on services which emphasises the critical role that the user-producer interactions and customisation play in the innovation process in services. This is a feature which is likely to be relevant only in few service sectors. Research institutes and patents and licences are perceived as a "relevant" sources of information by a minority of service firms.

---

<sup>9</sup> In 1992 the equivalent figure for the manufacturing sector was 17 million lire (the equivalent of \$ 10,000). Roughly speaking, therefore, innovating in manufacturing costs twice as much as in services.

Table 5: Sources of information for innovation

Sources	Firms for which the source is relevant	
	Number of firms	% on total innovating firms
<i>Internal sources:</i>		
Production/delivery	527	69,5
Marketing	413	54,5
Other internal sources	344	45,4
R&D	320	42,2
<i>External sources:</i>		
Suppliers of equipment, materials and components	583	76,9
Conferences, seminars, specialized journals, etc.	515	67,9
Consultancy firms	511	67,4
Competitors	469	61,9
Clients or customers	461	60,8
Fairs and exhibitions	395	52,1
Universities and higher educational institutes	180	23,7
Private research institutes	166	21,9
Patents, licences etc.	165	21,8
Public research institutes (excluding universities)	157	20,7
Other external sources	56	7,4

### Objectives of the innovations

Table 6 shows the importance attached by service firms to different objectives pursued with the introduction of innovation. The importance of different objectives is measured by the percentage of firms judging the different objectives as "relevant" (scores 4 and 5). Improving service quality is indicated as "relevant" by almost all innovating firms surveyed (92.1%), followed by the objective of improving working conditions (81.7%) and lower production costs (76.1%). These data confirm the particular attention placed by firms in improving the quality of services. Overall, with the exclusion of the objective of developing environmentally friendly products, innovation strategies in services appear to pursue a variety of objectives at the same time.

Table 6: Objectives of innovation

Objectives	Firms for which the objective is relevant	
	Number of firms	% on total innovating firms
Improving service quality	698	92,1
Improving working conditions	619	81,7
Lower production costs	577	76,1
Align the firm's technology to other firms'	571	75,3
Increase market share	558	73,6
Extend the service range	546	72,0
Improve production flexibility	517	68,2
Modify the service range	498	65,7
Maintain market share	473	62,4
Enter in new markets	432	57,0
Develop environment friendly products	222	29,3

### Obstacles to innovation

Table 7 investigates the importance of different factors which hamper or hinder the introduction of innovations in firms, showing the percentage of firms for which each factor was "relevant" (scores 4 and 5). Economic factors are considered as "relevant" by roughly one third of firms. In particular for 45.8% of firms the innovation cost is considered too high. It is interesting to note that the resistance to change within the firm ranks second (37.9%). This might suggest that organisational rigidities and professional bottlenecks represent important factors which prevent firms from introducing new technologies. This is confirmed by the fact that also the lack of skilled personnel is found among the most frequently mentioned hampering factors. Conversely, factors linked to the lack of technological opportunities and sufficient appropriability conditions, very much emphasised in the most recent literature, are not regarded as "relevant" by most of innovating firms.

Table 7: Factors hampering innovation

Obstacles	Firms for which the obstacle is relevant	
	Number of firms	% on total innovating firms
Innovation costs too high	347	45,8
Resistance to change within the firm	287	37,9
Pay-off period of innovation too long	260	34,3
Lack of skilled personnel	260	34,3
Innovation costs hard to control	240	31,7
Lack of customer responsiveness to new services	239	31,5
Lack of appropriate sources of finance	236	31,1
Innovation potential (R&D, design, etc.) insufficient	233	30,7
Constraints due to legislation, norms, regulations and standards	228	30,1
Lack of information on technologies	203	26,8
Perceived risk too high	194	25,6
Lack of appropriate external technical services	189	24,9
Lack of technological opportunities	159	21,0
Lack of information on markets	147	19,4
Risk to be imitated by competitors	127	16,8
Innovation is not a strategic factor	48	6,3
Innovation not needed because previously introduced	25	3,3

### The importance of technology for firms' performance

As mentioned in the previous section, in the literature it is often suggested that the definition and conceptualisation of innovation in services should be enlarged in order to encompass the introduction of new services, processes and organisational changes which have not a technological nature. In particular, it is argued that Non-technological innovations do play an important role in firms' strategies, especially in service firms. The Italian innovation survey sheds light on this issue providing data on the importance of technology for the economic performance of the firm in the period 1993-95; firms have also been asked to make an assessment for the period 1996-98. The question was formulated in such a way that firms could state whether technological innovation was not relevant (score 0), little relevant (score 1) to crucial (score 5).

Table 8 shows, for the service sector as a whole and at sectoral level, the percentage of firms for which technology was stated as "not relevant" (score 0), "little relevant" (scores between 1 to 3), and "very relevant" (scores 4 and 5). Data for the two periods 1993-95 and 1996-98 are shown in the Table 8.

Table 8: Importance of technology for firms' performance (% of firms)

Service sectors	Total	not relevant	1993-95		not relevant	1996-98	
	innovating firms (*)		of little importance	very important		of little importance	very important
Trade and repair of motorvehicles	32	18,8	71,9	6,3	21,9	53,1	21,9
Wholesale trade (excl. motorvehicles)	140	15,7	60,0	22,1	8,6	54,3	35,0
Retail trade	53	11,3	67,9	20,8	5,7	50,9	43,4
Hotel and Restaurants	40	30,0	62,5	7,5	20,0	47,5	32,5
Transport (excl. air)	87	21,8	63,2	13,8	10,3	57,5	32,2
Travel and transport services	51	19,6	52,9	27,5	11,8	49,0	39,2
Banking	142	12,0	63,4	24,6	2,1	45,8	52,1
Insurance	28	7,1	67,9	25,0	-	39,3	60,7
Other financial	12	16,7	66,7	16,7	8,3	33,3	58,3
Computing and software	51	15,7	51,0	33,3	2,0	31,4	66,7
R&D	15	-	40,0	46,7	-	26,7	60,0
Legal, Accounting	16	12,5	75,0	12,5	6,3	68,8	25,0
Engineering	19	10,5	57,9	31,6	-	31,6	68,4
Cleaning and security	35	14,3	60,0	25,7	5,7	48,6	45,7
Business services and advert.	18	5,6	77,8	16,7	5,6	38,9	55,6
Waste disposal	15	20,0	73,3	6,7	-	33,3	66,7
<b>Total</b>	<b>754</b>	<b>15,6</b>	<b>62,1</b>	<b>21,4</b>	<b>7,3</b>	<b>47,8</b>	<b>44,2</b>

(\*) Service sectors with less than 12 firms have been excluded

Looking at the past and at the service sector as a whole, firms for which technology is "very relevant" were a minority, only 21.4% of the total. For the rest of the firms, technology either did not play any role at all (15.6%) or had only a moderate importance (62.1%). The picture changes dramatically when firms look into the future: the percentage of them for which technology is going to be "very relevant" increases from 21.4% to 44.2%. Technology seems therefore to increase its importance as a strategic factor for firms' performance.

In the period 1993-95, industries displaying the highest percentages of firms stating that technology played a very relevant role are those with a strong technology base: research and development (46.7%), computer and software (33.3%) and engineering (31.6%). Sectors which attach less importance to technology are trade and repair of motor vehicles, waste disposal, hotels and restaurants (more that 90% of firms in these sectors stated that technology did not play an important role). Looking at the future, a process of convergence across sectors is going to take place: sectors for which in the past three years technology played a minor role, are those displaying the highest increase in percentages of firms considering technology very important. A case in point is waste disposal (from 6.7% to 66.7%), other financial services (from 16.7% to 58.3%), business services and advertising (from 16.7% to 55.6%) and hotel and restaurants (from 7.5% to 32.5%), insurance (from 25.0% to 60.7%). Whether this will end up in a process of technological catching-up of less innovative sectors

vis-à-vis more high technology service ones is something that should be looked at in the future.

## CONCLUSIONS

The results of the Italian Survey in the service sector provide a first empirical evidence on a variety of aspects of innovation activities. The most relevant results of this paper can be summarised as follows.

Technological innovation is quite a diffused phenomenon in market services: more than one third of surveyed firms have introduced technological innovations during the period 1993-95.

Most service firms can distinguish between service and process innovations. This result is important as part of the literature stresses the intimate linkage between the two and the practical impossibility to single out new services and new production and delivery processes.

Service firms rely on a wide range of innovation sources, often simultaneously. The acquisition and development of software, the purchase of machinery and equipment, the training of employees are the most cited. The mix of innovative activities varies significantly across sectors.

Taking as reference the innovation expenditure per employee, financial services, computing and software, engineering services and Post and telecommunications emerge as the most innovative service sectors.

When introducing innovations, service firms use various sources of information. Technological information is drawn mainly from in-house production/delivery departments as well as from outside suppliers of equipment, materials and components. Public and private research institutions as well as patents and licences play a very marginal role.

The two most important objectives of firms' innovation strategies consist of improving service quality and reducing cost.

Introducing innovations implies that firms have to face obstacles which are often of an economic nature - cost and risk too high - and in a significant number of cases linked to the resistance to change within the firm both from management and staff.

In the near future technology is going to increase its importance as a strategic factor for firm's performance in all fields.

**REFERENCES**

1. OECD, *Science, Technology and Industry Outlook*, OECD, Paris, 1996.
2. OECD, *Innovation, Patents and Technological Strategies*, OECD, Paris, 1996.
3. OCED, *Employment and Growth in the Knowledge-based Economy*, OECD, Paris, 1996.
4. OECD, *Oecd proposed guidelines for collecting and interpreting technological innovation data Oslo Manual*, Oecd/GD(92)26, Paris, 1989.
5. Sirilli, G., Science and technology indicators: The state of the art and prospects for the future, in *Economics of Structural and Technological Change*, Antonelli G., De Liso N., eds., Routledge, London (1997).
6. Kline, S. J., Rosenberg, N., An Overview on Innovation, in *The Positive Sum Strategy*, Landau, R., Rosenberg, N., eds., National Academy Press, Washington DC, 1986.
7. Lundvall, *National Systems of Innovation*, Pinter, London, 1992.
8. Brouwer, E., Kleinknecht, A., An innovation survey in services. The experience with the CIS questionnaire in the Netherlands, in OECD, *STI Review*, 16, Paris (1995).
9. Australian Bureau of Statistics, *Innovation in selected Australian industries*, ABS Catalogue No. 8118.0, 1995.
10. Evangelista, R., Sirilli, G., Measuring innovation in services, *Research Evaluation*, 5(3), 207-215 (1995).
11. OECD, *STI Review, Special issue on innovation and standards*, 16, OECD, Paris, 1995.
12. Archibugi, D., Cesaratto, S., Sirilli, G., Sources of innovative activities and industrial organisation in Italy, *Research Policy*, 20, 299-313 (1991).
13. OECD-EUROSTAT, *Proposed Guidelines for Collecting and Interpreting Technological Innovation Data - Oslo Manual*, OECD, Paris, 1997.
14. EUROSTAT, *Report of the Eurostat pilot project to investigate the possibilities to measure innovation in the service sectors*, Luxembourg, 1995.
15. Evangelista R., Sandven T., Sirilli G., Smith K., Measuring the Cost of Innovation in European Industry, *paper presented to the Eurostat/DG XIII International Conference on Innovation Measurement and Policies*, Luxembourg, May 20-21, 1996.
16. Miles, I., Services innovation, statistical and conceptual issues, *Working Group on Innovation and Technology Policy*, OECD (Doc. DSTI/EAS/STP/NESTI/(95)12, Paris, March, 1995).

17. Miles, I., Services in the new industrial economy, *Futures*, 25(6), 653-672 (1993).
18. Miles, I., Infrastructure and the Delivery of New Services, in *Employment and Growth in the Knowledge-based Economy*, OECD, Paris (1996).
19. ISTAT, *Indagine sull'innovazione tecnologica, Anni 1990-92*, Rome, 1995.
20. Gault, F. D., Pattinson, W., Innovation in service industries: the measurement issues, *paper presented to the Voorburg Group Meeting*, Voorburg (Netherlands), September 11-15, 1995.
21. OECD, *Technology and the Economy: the Key Relationships*, OECD, Paris, 1992.
22. Evangelista, R., Embodied and Disembodied innovative activities: evidence from the Italian innovation survey, in *Innovation, Patents and Technological Strategies*, OECD, Paris (1996).
23. Evangelista, R., Perani, G., Rapiti, F., Archibugi, D., Nature and impact of innovation in manufacturing industry: some evidence from the Italian innovation survey, *Research policy* 26(4,5), 521-536, 1997.

## APPENDIX

### *Methodology of the survey on innovation in the service sector in Italy*

The data set forth in this paper are some preliminary results of a pilot survey on service firms carried out in Italy by ISTAT (National Statistical Institute) in collaboration with the Institute for Scientific Research and Documentation of the National Research Council.

The statistical population covered by the survey is composed of the total number of service firms with more than 200 employees and a sample of firms employing between 20 and 200 employees. The target population is made of 6,005 firms, of which 1,245 with more than 200 employees and 4,760 sampled through a stratified random sample based on economic activity, firm size and geographical location, from a universe of 19,300 firms.

The following service sectors have been covered:

- trade, maintenance and repair of motor vehicles
- wholesale trade (excluding motor vehicles)
- retail trade
- hotels and restaurants
- land transportation
- shipping and sea transportation
- travel and transport services
- postal and telecommunication services
- financial services
- insurance and pension funds
- auxiliary activities for financial intermediation
- computer and informatics-related services
- research and development services
- legal, accounting, fiscal services
- architectural, engineering, technical services
- advertising
- security and cleaning services
- other business services
- waste disposal

The data have been collected through a mail questionnaire prepared on the basis of the standards and definitions of the OECD "Oslo Manual". There are however some little definitional differences due to the fact that at the time of printing of the questionnaire the 1997 Oslo Manual had not yet been published. The questionnaire was sent out in November 1996; a remainder was sent to non responding firms on February 1997.

The questionnaire is made of 11 questions on the following issues: type of innovations introduced (service, process/delivery), innovation expenditure, sources of information for innovation, objectives, impact of innovation on sales and on employment, obstacles to innovation, future programs for innovation.

The following definitions have been used in the questionnaire.

*Technology* can be defined, in a broad sense, as the complex set of knowledge, capabilities, routines, competencies, equipment and technical solutions necessary to produce a product or deliver a service.

*Service and process technological innovations* comprise technologically new or significantly improved products and services. An innovation has been implemented if it has been introduced on the market (service innovation) or has been used within a production or delivery process (process innovation). Usually, the introduction of service and process technological innovations involves a series of scientific, technological, organisational, financial and commercial activities.

A *service* is considered to be technologically innovative when its characteristics and modalities of use are either completely new or have been significantly improved from qualitative point of view, or in terms of their performance and technologies used. The introduction of a technologically innovative service can require the use of radically new technologies, a combination of pre-existing technologies or new knowledge. A service consisting of a set of a number of integrated technical sub-systems can be technologically improved by changing one or more of the sub-systems.

A *process innovation* consists of the adoption of a production or a delivery method which is new from a technological point of view. Such adoption may involve changes in equipment, organisation of production or a combination of both. The introduction of process innovation may be intended to produce or deliver innovated services which cannot be produced or delivered using pre-existing production methods or to improve the production or delivery efficiency of existing services.

The information collected through the questionnaire refers to innovations introduced into the firm in the period 1993-1995. Some questions, however, refer to the year 1995.

On May 15 1997 ISTAT had received 3,258 questionnaires filled out, i.e. 54.3% of the total sample. The response rate has been rather uniform across firm size (with a maximum of 58% for the 200 and more employees class) but rather diversified across sectors. A non-response analysis will be carried out after the closing of the survey. The data set forth in this paper regard 2,056 firms, of which 758 have introduced innovations; the latter represent 36.9% of the number of firms and 63.1% in terms of employees.

In terms of the reliability of the data, previous experience with similar surveys and the results of preliminary exercises aimed at re-proportioning the sample to the statistical population make us to believe that the data published in this paper are sufficiently reliable and can be used for a preliminary analysis.

Some lessons have been learnt in conducting the survey. Technological innovation is something quite diverse from firm to firm and from sector to sector. The concept of technological innovation underlying the questionnaire has apparently been rather well understood by respondents on the basis of both the definitions reported on the first page of the questionnaire and, in particular, on the examples of innovation. It is possible that the fact that most of the examples of innovation impinge on information technologies may have biased the sample.

The identification of the respondent to the questionnaire within the firm proved to be difficult in large firms. Especially in service firms which have a decentralised structure it is difficult to identify the person who has an overall view of a scattered phenomenon such as innovation.

Given the fact that the questionnaire is addressed to legal entities, the industry's structure determines the type of results achieved through the survey. For example in the insurance industry it has to be distinguished between large insurance companies operating at the national and international level and individual insurance agents who are intermediaries tightly linked - especially in the innovation sphere - to insurance companies, but who filled out the questionnaire as fully fledged firms. Another example is gasoline stations which in some cases are outlets of a large petrol company, and in other are fully independent firms.

The evaluation of the impact of innovation on sales proved to be difficult: only 327 out of 758 firms have been able to give some figures. The majority of firms not providing information on this question stated that it is impossible to quantify the impact of innovation on sales, often because the rigidity of accountancy procedures or the time lags between the introduction of the innovation and the riping of the corresponding benefits.