

Innovation output and barriers to innovation

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The third round of the Community Innovation Survey (CIS3) provides data on, among other subjects, innovation outputs and barriers to innovation. These are the main focus of this publication, which concentrates on an EU aggregate that has been created from the data for 12 Member States (excluding Ireland, Luxembourg and the United Kingdom for reasons of availability). When reference is made to the EU in the text, it is to this aggregate for the 12 Member States, rather than the EU as a whole.

The main questions treated by this publication include:

- how many enterprises innovate?
- what were the effects of innovation on enterprises, for example, in terms of turnover, market share, production flexibility, safety or other measures?
- how do enterprises protect the results of their innovation activities?
- what barriers do enterprises face in their efforts to innovate?

1. Enterprises with innovation activity

Figure 1: Enterprises with innovation activity in the EU, by enterprise size class and by sector, 1998-2000 (% of all enterprises)

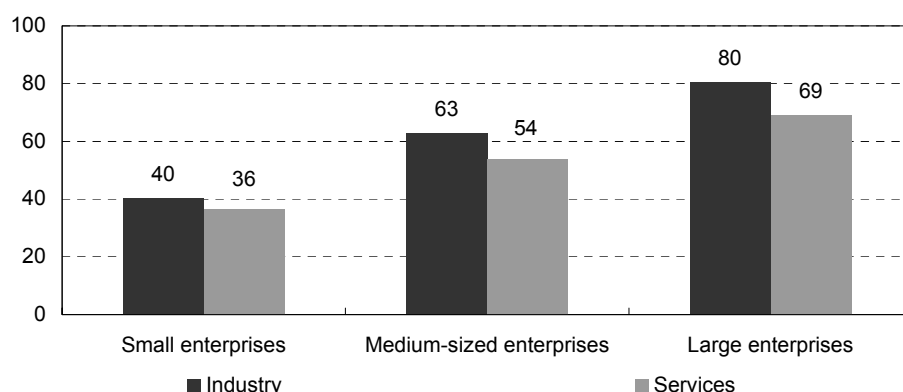


Table 1: Innovation activity in the EU, number and proportion of enterprises, by type of enterprise and by sector, 1998-2000

	Number of enterprises (thousands)	Proportion of all enterprises (%)		
		All (industry & services)	Industry	Services
Enterprises with innovation activity	201	44	47	40
Successful innovators	186	41	44	36
Product only	47	10	10	11
Process only	32	7	8	5
Product and process	106	23	25	20
On-going & abandoned	15	3	3	4
Enterprises without innovation activity	256	56	53	60

Statistics in focus

SCIENCE AND TECHNOLOGY

THEME 9 – 1/2004

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According to CIS3 there were just over 200 000 enterprises with innovation activity in the EU during the period 1998 to 2000, some 44 % of the total survey population (table 1). Note that only enterprises with 10 or more employees were included in the survey.

The propensity to innovate was somewhat higher in the EU's industrial sector (47 % of enterprises) than it was in the services sector (40 %).

This relationship was reproduced across the three different size classes for which data are available (figure 1), as industrial enterprises reported a higher propensity to innovate among small, medium-sized and large enterprises.

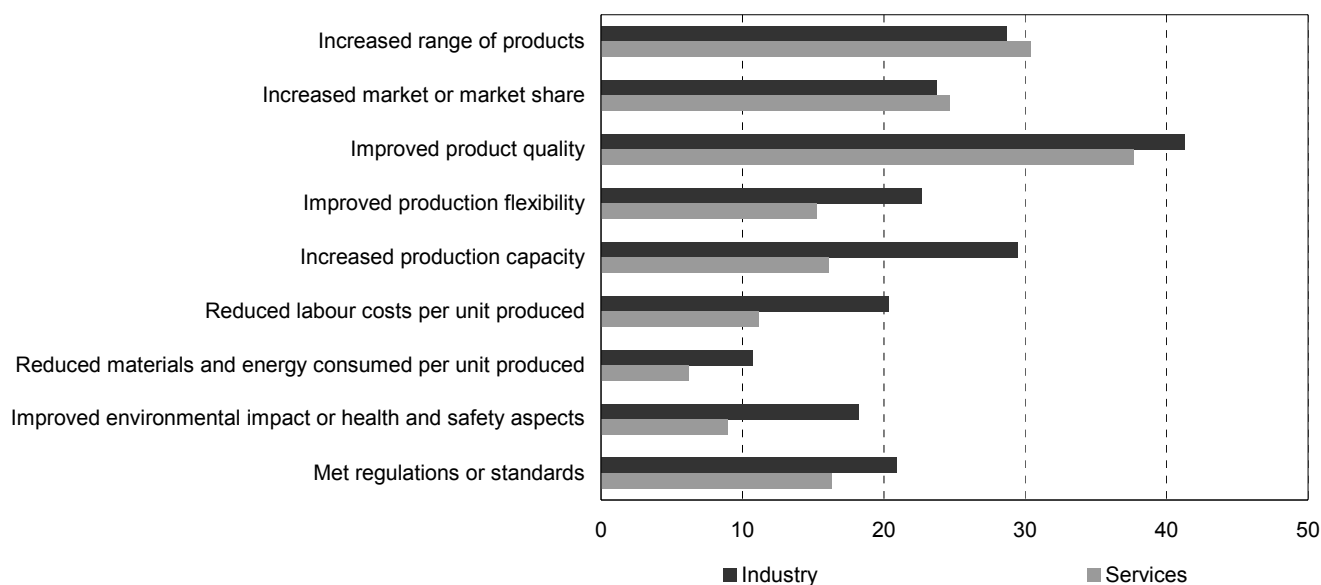
The difference between the proportion of enterprises with innovation activity in the industrial sector and the services sector rose as a function of the average size of the enterprise. Among small industrial enterprises the proportion of enterprises with innovation activity was 4 percentage points higher than the corresponding figure for services. The difference rose to 9 points for medium-sized enterprises and 11 points for large enterprises.

Most successful innovators carried out both product and process innovations. In the industrial sector of the EU these accounted for 25 % of all enterprises, while the proportion of enterprises that were both product and process innovators in the services sector was 20 %.

Some 8 % of all enterprises in the industrial sector were process only innovators compared to 5 % in the services sector. The share of enterprises with only on-going and/or abandoned innovations was even lower in both the EU's industrial economy (3 %) and the services sector (4 %).

2. Effects of innovations

Figure 2: Proportion of EU enterprises with innovation activity indicating that innovation had a high degree of impact on selected effects, 1998-2000 (%)



It would appear that a higher proportion of industrial enterprises with innovation activity (as opposed to services enterprises), believe that innovations have an impact on their business (figure 2). A considerably higher proportion of industrial (as compared to services') enterprises with innovation activity indicated that innovation had a high impact on process oriented effects. Similar differences were recorded for the effects of innovations with respect to

environmental impact or health and safety. Indeed, increasing the product range and increasing market share were the only two effects that were cited by more respondents from the services sector (as compared to industry).

The most important impact (for industrial and services enterprises) was in terms of improving product quality. The next most important impact in industry was to increase

production capacity, while in services it was to increase the range of products being offered.

Large industrial and services enterprises with innovation activity stressed more than SMEs (small and medium-sized enterprises), the relative importance of product oriented effects of innovations, in particular their facility to increase their range of products (table 2).

Effects of innovations (continued)

Table 2: Industrial enterprises with innovation activity in the EU that declared that innovation had a high degree of impact on selected effects, by size-class, 1998-2000

	Enterprises with innovation activity (absolute figures)	Proportion of enterprises with innovation activity indicating specified effect (%)			
		All	Small	Medium	Large
Product oriented effects					
Increased range of products	37 280	29	24	34	56
Increased market or market share	30 870	24	20	28	45
Improved product quality	53 620	41	41	39	56
Process oriented effects					
Improved production flexibility	29 445	23	21	23	33
Increased production capacity	38 242	29	30	27	36
Reduced labour costs/unit produced	26 402	20	20	19	28
Reduced materials, energy consumed per unit produced	13 897	11	9	12	21
Other effects					
Improved environmental impact or health, safety aspects	23 690	18	18	17	28
Met regulations or standards	27 155	21	21	18	27

Table 3: Services enterprises with innovation activity in the EU that declared that innovation had a high degree of impact on selected effects, by size-class, 1998-2000

	Enterprises with innovation activity (absolute figures)	Proportion of enterprises with innovation activity indicating specified effect (%)			
		All	Small	Medium	Large
Product oriented effects					
Increased range of products	21 661	30	29	31	48
Increased market or market share	17 581	25	24	24	35
Improved product quality	26 867	38	36	40	51
Process oriented effects					
Improved production flexibility	10 836	15	13	19	24
Increased production capacity	11 472	16	14	19	29
Reduced labour costs/unit produced	7 935	11	10	13	18
Reduced materials, energy consumed per unit produced	4 390	6	5	9	7
Other effects					
Improved environmental impact or health, safety aspects	6 390	9	8	11	9
Met regulations or standards	11 604	16	15	18	19

3. Protection of innovations

Between 1998 and 2000 the most popular methods to protect innovations were strategic as opposed to formal (table 4). In the industrial sector, 20 % of all enterprises stated that lead-time advantages on their competitors were their most frequently used protection method, while the corresponding share in the services sector was 19 %. Secrecy was the next most used method with 15 % of

all industrial enterprises and 13 % of all services' enterprises employing it. The least used method was copyrighting, cited by just 2 % of industrial enterprises and 5 % of those in services.

Tables 4 and 5 show the difference between the proportion of all enterprises and the proportion of enterprises with innovation activity that used these various protection

methods. Note that an enterprise that was classified as having no innovation activity during the period 1998-2000 may well have made innovations prior to this date that remained patented or protected by another means. Nevertheless, it is not surprising to see that enterprises with innovation activity (table 5) made relatively more use of protection methods than the whole enterprise population (table 4).

Protection of innovations (continued)

There are some interesting differences across size classes, as in both the industrial and the services sectors, large enterprises tended to have a much higher recourse to use the various protection methods than their small and medium-sized counterparts.

A sectoral comparison shows that a much higher proportion of enterprises in the industrial sector used the various protection methods; the deviation between industry and services was particularly pronounced among large enterprises.

Among industrial enterprises with innovation activity (table 5) there was far less use of protection methods among process only innovators. Indeed, they used the various forms of protection less than industrial enterprises with only on-going and/or abandoned innovations.

Table 4: Protection methods for innovations in the EU, by sector and by size-class, 1998-2000 (1)

	Industry					Services				
	All enterprises (absolute figures)	Proportion of enterprises making use of specified methods (%)				All enterprises (absolute figures)	Proportion of enterprises making use of specified methods (%)			
		All	Small	Medium	Large		All	Small	Medium	Large
Registration of design patterns	22 976	8	5	14	41	10 252	6	5	8	17
Trademarks	36 337	13	9	20	50	21 961	12	10	19	31
Copyrights	6 657	2	1	4	14	8 915	5	4	8	17
Secrecy	43 037	15	11	23	57	23 798	13	12	18	34
Complexity of design	26 984	10	7	14	32	16 993	10	8	12	25
Lead-time advantage on competitors	54 578	20	15	28	62	33 476	19	16	26	45

(1) Note that the reference population is all EU enterprises.

Table 5: Protection methods for innovations in the EU, by sector and by type of innovator, 1998-2000 (1)

	Industry						Services					
	Enterprises with innovation activity (absolute figures)	Proportion of enterprises with innovation activity making use of specified methods (%)					Enterprises with innovation activity (absolute figures)	Proportion of enterprises with innovation activity making use of specified methods (%)				
		All	Prod. and/or proc.	Prod. only	Proc. only	On-going and/or abandoned		All	Prod. and/or proc.	Prod. only	Proc. only	On-going and/or abandoned
Registration of design patterns	19 136	15	15	22	6	10	8 469	12	:	14	:	:
Trademarks	26 624	20	21	28	12	17	15 207	21	:	28	:	:
Copyrights	4 852	4	4	6	2	2	7 495	11	:	13	:	:
Secrecy	35 442	27	27	36	17	24	19 645	28	:	28	:	:
Complexity of design	22 653	17	18	22	10	12	14 667	21	:	25	:	:
Lead-time advantage on competitors	43 912	34	34	45	25	25	27 708	39	:	47	:	:

(1) Note that the reference population is all EU enterprises with innovation activity.

4. Barriers to innovation

Generally, a higher proportion of enterprises with innovation activity reported hampering factors than enterprises without innovation activity.

The main hampering factors that prevent innovation may be grouped together under the collective term of 'economic factors'. In particular, innovation costs are perceived as being too high among sub-

populations of enterprises with and without innovation activity. A lack of information was generally perceived as being the least highly important factor hampering innovation efforts in the EU.

Figure 3: Proportion of enterprises in the EU that declared that selected hampering factors had a high degree of impact, by type of enterprise, 1998-2000 (%)

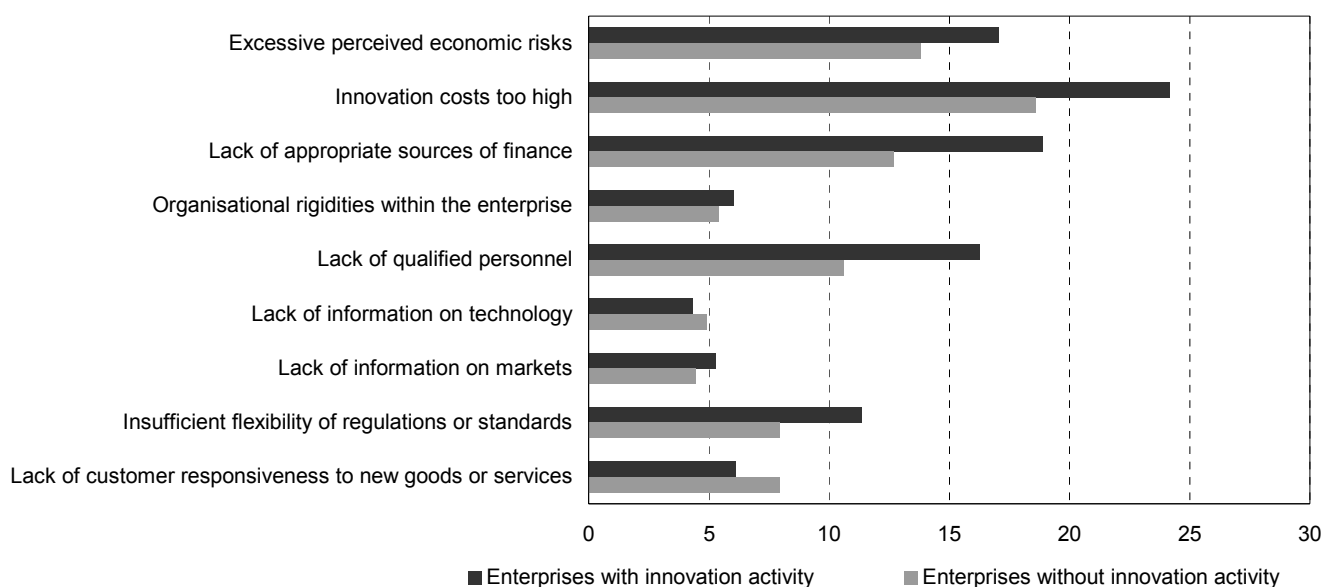


Table 6: Enterprises in the EU without innovation activity that declared that selected hampering factors had a high degree of impact, by sector and by size-class, 1998-2000

	Industry					Services				
	Enterprises without innovation activities (absolute figures)	Proportion of enterprises without innovation activities indicating specified hampering factors (%)				Enterprises without innovation activities (absolute figures)	Proportion of enterprises without innovation activities indicating specified hampering factors (%)			
		All	Small	Medium	Large		All	Small	Medium	Large
Economic factors										
Excessive perceived economic risks	22 406	15	16	11	9	12 936	12	12	13	7
Innovation costs too high	30 241	20	21	15	13	17 390	16	16	16	9
Lack of appropriate source of finance	20 008	13	14	10	7	12 493	12	12	10	7
Internal factors										
Organisational rigidities within the enterprise	8 103	5	6	5	5	5 717	5	5	4	5
Lack of qualified personnel	17 858	12	12	10	5	9 305	9	9	9	3
Lack of information on technology	7 863	5	6	3	1	4 682	4	4	4	2
Lack of information on markets	7 491	5	5	3	1	3 923	4	4	4	2
Other factors										
Insufficient flexibility of regulations or standards	10 504	7	7	5	3	9 894	9	10	6	5
Lack of customer responsiveness to new goods or services	12 294	8	9	6	8	8 126	8	8	5	3

Barriers to innovation (continued)

Table 6 (on the previous page) provides a breakdown of hampering factors with respect to enterprises without innovation activity. It shows that there were relatively small differences across size-classes in both industry and services with respect to the proportion of enterprises reporting each of the selected hampering factors.

However, when looking at the differences between each of the size classes within the industrial or the services sector, there was a clear size-class effect evident. The proportion of enterprises reporting each hampering factor decreased as a function of enterprise size, with a higher proportion of small enterprises being hampered for each effect identified, except for excessive perceived economic risks in services (cited by a higher proportion of medium-sized enterprises in the services sector).

Economic factors were cited most often as a hampering factor within each of the three enterprise size classes.

Table 7 shows a similar set of information, but for the whole enterprise population. In terms of a comparison between industry and services there was again very little difference in the proportion of enterprises reporting each hampering factor. Indeed, with only one exception there was no more than 1 percentage point difference between the proportion of industrial and services' enterprises citing each factor. The exception was 'insufficient flexibility of regulations and standards', which was cited by 12 % of enterprises in the services sector as being a hampering factor with a high degree of impact, compared to 8 % of enterprises in the industrial sector.

When looking at a breakdown by type of innovator there is little data for the services sector. Among industrial enterprises, the group that was most likely to cite hampering factors as having a high degree of impact was enterprises with on-going and/or abandoned innovation activity. Indeed, this sub-population had the highest proportion of enterprises citing each hampering factor, with the exception of a lack of customer responsiveness to new goods or services, which was cited by a higher proportion of enterprises without innovation activity.

Table 7: Enterprises in the EU that declared that selected hampering factors had a high degree of impact, by sector and by type of enterprise, 1998-2000

	Industry						Services					
	All enterpr. (absolute figures)	Proportion of enterprises indicating specified hampering factors (%)					All enterpr. (absolute figures)	Proportion of enterprises indicating specified hampering factors (%)				
		All	Enterpr. with inno. activity	Prod. and/or proc.	On-going and/or abandoned	Enterpr. without inno. activity		All	Enterpr. with inno. activity	Prod. and/or proc.	On-going and/or abandoned	Enterpr. without inno. activity
Economic factors												
Excessive perceived economic risks	42 849	15	16	16	18	15	26 835	15	19	:	:	12
Innovation costs too high	60 067	21	23	23	24	20	36 202	20	26	:	:	16
Lack of appropriate source of finance	42 315	15	17	17	21	13	28 238	16	22	:	:	12
Internal factors												
Organisational rigidities within the enterprise	15 188	5	5	5	11	5	10 749	6	7	:	:	5
Lack of qualified personnel	37 067	13	15	15	18	12	22 835	13	19	:	:	9
Lack of information on technology	14 071	5	5	5	8	5	7 180	4	4	:	:	4
Lack of information on markets	14 254	5	5	5	6	5	7 780	4	5	:	:	4
Other factors												
Insufficient flexibility of regulations or standards	22 623	8	9	9	15	7	20 628	12	15	:	:	9
Lack of customer responsiveness to new goods or services	19 077	7	5	5	5	8	13 711	8	8	:	:	8

➤ ESSENTIAL INFORMATION – METHODOLOGICAL NOTES

The first Community Innovation Survey (CIS1) was carried out in 1993 and the second round (CIS2) in 1997/1998. The third round (CIS3) was implemented in 2000/2001. Norway, Iceland, Luxembourg and Greece launched it in 2002.

CIS3 covered the period 1998 to 2000; while the reference period was 1999 to 2001 for Norway. As in previous Community Innovation Surveys, CIS3 was based on the Oslo Manual (second edition from 1997) which gives methodological guidelines and defines basic innovation concepts. CIS3 data were collected using a common core questionnaire and survey methodology developed by Eurostat in close co-operation with the EU Member States. The objective was to have comparable, harmonised and representative data on a pan-European scale. The Spanish data is based on an earlier version of the CIS3 questionnaire. The organisations responsible for CIS3 at a national level were in most cases the National Statistical Office or a government ministry.

TARGET POPULATION

The statistical unit in CIS3 was the enterprise. The target population was the population of enterprises with 10 employees and more. Industry is an aggregate of NACE Sections C to E and the services sector is an aggregate of the remaining NACE headings:

Mining and quarrying	Section C
Manufacturing	Section D
Electricity, gas and water supply	Section E
Wholesale trade	Division 51
Transport, storage and communication	Section I
Financial intermediation	Section J
Computer and related activities	Division 72
Research and development	Division 73
Architectural and engineering activities	Group 74.2
Technical testing and analysis	Group 74.3

SURVEY METHOD

Innovation data from CIS3 was in most cases collected using a stratified sample survey. The samples in CIS3 were drawn by using random selection in each stratum, the latter being defined by a combination of employee size classes and NACE Divisions.

It is expected that the final CIS3 data will be based on answers from more than 60 000 enterprises spread across the EU Member States, Norway and Iceland. The response rates varied from as low as 22 % to over 80 %. The results presented are grossed-up figures for the whole population; the results of a non-response analysis may also have been taken into account by some countries.

CIS3 definitions

Innovation

An *innovation* is a new or significantly improved product (good or service) introduced to the market or the introduction within an enterprise of a new or significantly improved process. Innovations are based on the results of new technological developments, new combinations of existing technology or the utilisation of other knowledge acquired by the enterprise.

Innovations may be developed by the innovating enterprise or by another enterprise; however, purely selling innovations wholly produced and developed by other enterprises is not included as an innovation activity.

Innovations should be new to the enterprise concerned; for product innovations they do not necessarily have to be new to the market and for process innovations the enterprise does not necessarily have to be the first to have introduced the process.

A *product innovation* is a product (good or service) which is either new or significantly improved with respect to its fundamental characteristics, technical specifications, incorporated software or other immaterial components, intended uses, or user friendliness. Changes of a solely aesthetic nature are not included.

A *process innovation* includes new and significantly improved production technology, methods of supplying services and of delivering products. The outcome (of the process) should be significant with respect to the level of output, quality of products or costs of production and distribution. Purely organisational or managerial changes are not included.

Enterprises with innovation activity

Enterprises that have had any kind of innovation activity during the survey period, i.e. have introduced or implemented new products and/or processes and/or have had on-going and/or abandoned innovation activity.

Successful innovators

Enterprises that have introduced or implemented new products and/or processes.

Size classes

The following size classes, based on the number of employees, were used for the compilation of aggregated results:

Small enterprises	10 to 49 employees
Medium-sized enterprises	50 to 249 employees
Large enterprises	250 or more employees

Symbols

: Not available.

The data used for this publication were extracted on 07/01/2004.

Further information:

➤ Reference publications

Title Innovation in Europe (forthcoming)

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