

**SPANISH CONTRIBUTION TO THE
OECD CLUSTER FOCUS GROUP WORKSHOP ON
"DO CLUSTERS MATTER IN INNOVATION POLICY?"**

UTRECHT, 8-9 MAY 2000

**INNOVATION IN THE SPANISH
INFORMATION AND COMMUNICATION (ICT)
CLUSTER**

CRISTINA CHAMINADE
(cristina.chaminade@uam.es)

This is a draft. Comments are welcome. Quotation not allowed without the permission from the author.

INDEX

1. Introduction.....	3
2. Description of the ICT cluster.....	4
3. Innovation in the ICT cluster.....	5
4. Conclusions.....	16
5. References.....	17

1. Introduction¹

Innovation has become a crucial asset in all developed economies and policy makers are becoming increasingly aware of the role played by innovation in the development of a large number of industries. A great proof of that is the creation in Spain of a new Ministry of Science and Technology in April 2000.

A better insight into innovation processes is needed, both at the National and industrial level. Innovation Surveys at national and international level, have been largely used to map innovation processes at national and international level (Arundel, 1996; Calvert et al, 1996; Evangelista et al, 1996, Sanchez & Chaminade, 1999a and 1999b). Industry specific analysis using the Innovation Survey data are becoming to emerge, usually at national level. This paper's main purpose is to map innovation processes in the Spanish ICT cluster, using the Spanish Innovation Survey data (INE, 1999).

The ICT cluster has become one of the major economic driving forces in the so called New Economy. ICT are shaping the new society by means of changing the way firms make business, the knowledge generation, diffusion and acquisition processes, the quality of life, etc.

In 1998, more than 25 per cent of the US economic growth was due to these technologies, as it was stated by the US Department of Commerce in a Report called the Digital Economy (Ilkovitz; Mogesen, 1999).

Following OECD data, the ICT cluster has accounted for a share of GDP between 2,5 and 4,5 per cent, being the most recent data significantly higher; for example, 8 per cent of the GDP in the US (IT, 1998 data), 6,1 per cent for Canada (ICT, 1999 data), 5,2 for France (IT, 1999 data) (OECD, 2000), or 5 per cent for Spain (COTEC, 2000).

Both in quantitative and qualitative terms, it seems clear that the ICT cluster is transforming the economy and the society. Their widespread use increases the efficiency of the markets, therefore accelerating growth. For this reason it is of special relevance to know the degree of penetration of these technologies in the economy and the determinants of their growth and diffusion.

In this sense, **innovation** is considered to be one of the key factors explaining growth in the ICT cluster. The present paper focuses on the description of the

¹ This paper is based on a previous work done for the COTEC Foundation, on *Innovation in the ICT industries* which will be published in May (COTEC, 2000). The COTEC Foundation is an entrepreneurial organisation whose main purpose is to support technological innovation within the Spanish business and society. We would like to thank their support in providing all the statistical data.

innovation processes in the Spanish ICT cluster, using as the main source of information the Spanish 1999 Innovation Survey.

Next section is devoted to the description of the Spanish ICT cluster, its composition for the shake of this analysis, and its weight in relation to the Spanish Economy. Next the results of the Spanish Innovation survey will be analysed and finally, some conclusions will be drawn.

2. Description of the ICT cluster

One of the main question to tackle when trying to analyse this cluster is what to consider as being part of it. In most of the international sources of information ICT is considered to be compounded just by the Information Technologies (Computer goods and services) and the Telecommunications (Goods and Services). This is clearly the approach used by International Bodies such as the OECD (IT and ICT outlook), or the EITO (European Information Technology Observatory) Annual Report.

The technological convergence of these technologies and the intensity of the existing links with other industries, such as electronics or the content providers is, somehow, questioning the scope of this "narrow" composition. Some national initiatives, such as the COTEC report on the ICT cluster in Spain (COTEC, 2000) or the Dutch ICT cluster analysis (Brouwer and den Hertog, 1999) are widening the notion of the ICT cluster, including also the Electronic industry and the Content providers.

This second approach will be the one used in this paper, including in the analysis the Electronic Industry.

Box 1. Composition of the Spanish ICT cluster

ICT Hardware

- Electronic and Fotonic components
- Consumer Electronics
- Professional Electronics
- Telecommunication Equipment
- Computer Hardware
- Software

ICT Services

- Telecommunication Services
- IT services

A detailed description of each sub-cluster can be found in Chaminade (1999):

- **Electronic and Fotonic Components:** Electronic devices used in the Electronic, IT and Telecommunication Equipment (Lazaro, 1998), such as electronic valves and tubes, etc.
- **Consumer Electronics:** Electronic goods for domestic use such as TV, Radio, Hi-Fi, etc.
- **Professional Electronics:** Systems and Equipment used in some specialised industries and services as well as infrastructure (motorways, trains, etc). This sub-cluster is usually broken down into Defence, Electromedical and Industrial electronics.
- **Telecommunication Equipment:** Machines for the transportation, retrieving and processing of voice, image and sound.
- **IT Equipment:** Machines for the transportation, processing and retrieving of data (Hardware) and commercially available packaged programmes (Software).
- **Telecommunication Services:** Telephone, Mobile, switched data and leased-line services, caTV services, etc. (EITO, 1999)
- **IT Services:** Customised software, IT-related training, consulting, support services, etc.
- **Audiovisuals:** TV and Radio diffusion services such as standard and pay per view TV, radio, etc.

In 1998 the number of firms in the ICT cluster reached 1525 (INE, 1999), employing nearly 210.000 persons. The Spanish ICT cluster accounts for more than 5 per cent of the national GDP. However if we consider just the industrial side of the cluster to the industrial GDP, using the data provided by ANIEL (1999) and SEDISI (1999) the ratio grows up to 8,4 per cent. In terms of inter-annual growth rates, the Spanish ICT cluster production grew by 14 per cent between 1997 and 1998, while the Spanish economy reached 4 per cent. ICT markets account for 8,21 per cent of the whole Spanish market (taking as a proxy measure the National Accounts Demand).

That is, the ICT cluster can be consider, at present, one of the most important industries in Spain, in terms of its contribution to the Spanish GDP. Its future evolution will depend on its innovative capacity, the ability to create new products and services and to compete internationally. Next section will be devoted to the analysis of innovation in the ICT cluster.

3. Innovation in the ICT cluster

All the results presented in this section are based on the Spanish Innovation Survey (SIS, henceforth), which was conducted in 1998, covering all industries (NACE 31) and the Telecommunication Services. The SIS does not cover all the industries considered under the ICT cluster. It provides information for the following sub-clusters:

- Consumer electronics (NACE 32.3)
- Electronic components (NACE, 32.1)
- Industrial Electronics (NACE 33.3)
- Telecommunication equipment (NACE 32.2)
- IT Equipment (NACE 30.0)
- Telecommunication Services (NACE 64.2)

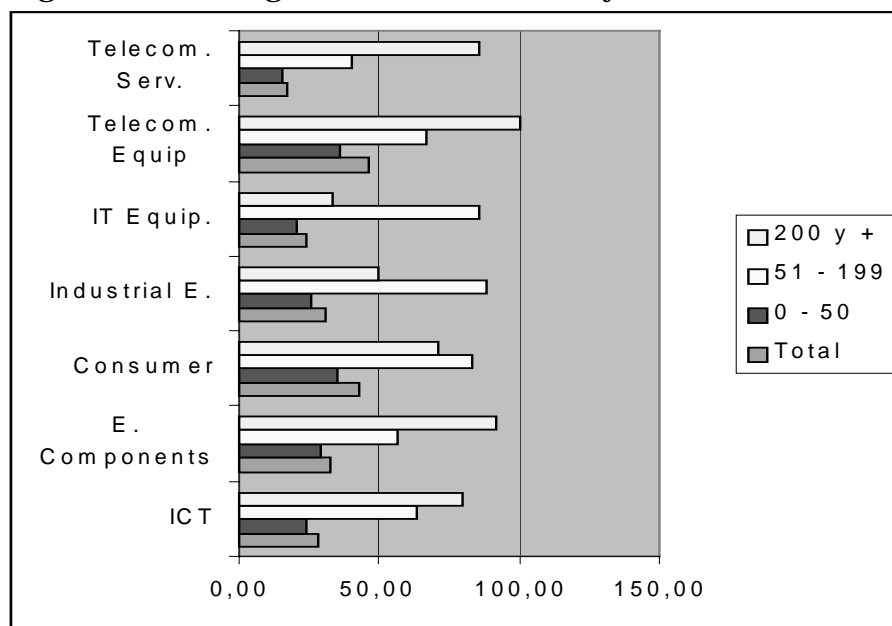
Henceforth, and due to these data restrictions, when we refer to the ICT cluster we will not be considering the rest of Professional Electronics, Software, IT services and Audiovisuals.

Innovative firm is defined by the SIS as the one which has successfully introduced a new product, process or service during the period 1996-1998. In that sense the SIS follows the Oslo Manual (OECD, 1996).

Considering this definition, 28 per cent of the Spanish ICT firms are innovative, and this ratio goes up to 34 per cent when we consider only the ICT industries (that is, excluding Telecom services), which is clearly above the Spanish industrial average: only 10 per cent of the Spanish firms has introduced a new product, process or service during the considered period. The detected gap between the ICT and the Spanish economy, is a common result in all developed countries which can be explained by the important role that innovation plays in the competitiveness of this cluster.

The breakdown by sub-industries, shows that Consumer Electronics and Telecom Equipment present the higher proportion of innovative firms over the total (43 and 46 respectively).

Figure 1. Percentage of Innovative firms by sub-cluster and size



Source: COTEC (2000)

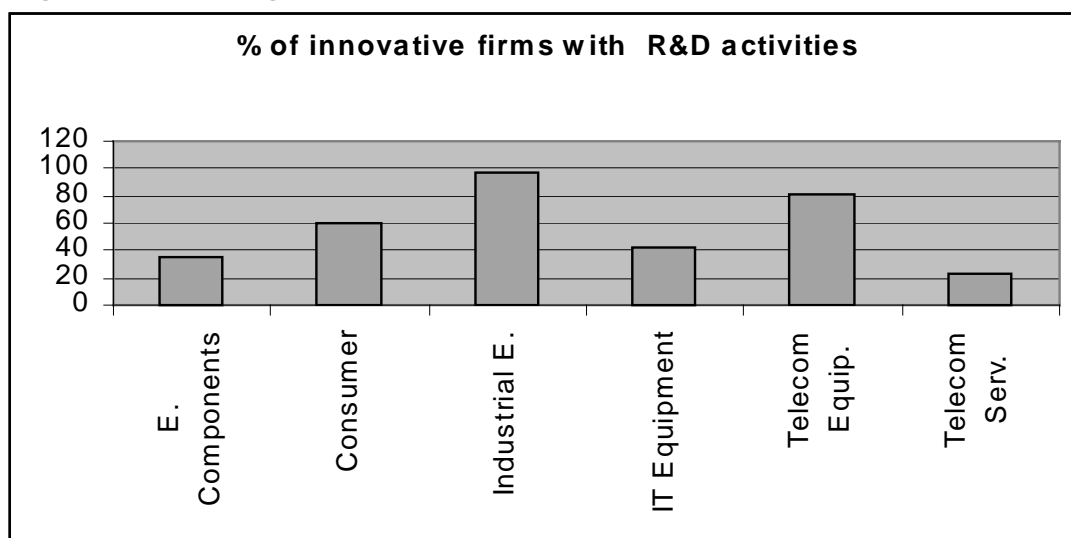
Due to the small size of the Spanish firms, the SIS considers the following groups: 1-5 employees, 6-20 empl., 21-50 empl., 51-199 empl. and 200 and more employees. For the shake of the analysis we have grouped the first three categories into one.

Almost 90 per cent of the ICT firms have less that 50 employees, 6 per cent have between 50 and 200 workers and finally only 3 per cent have more than 200. As expected the proportion of innovative firms varies sensibly by breakdown of size, but the reported differences between small and medium size firms and big firms in the ICT cluster are smaller than those of the Spanish businesses.

Innovative ICT firms are responsible for the 88 per cent of the total cluster turnover and 80 per cent of the exports volume. ICT industrial firms account for almost 4 per cent of the total turnover of the Spanish businesses.

More than half of the ICT firms in the cluster have R&D activities, but the proportion varies greatly between sub-industries as can be seen in Figure 2.

Figure 2. Percentage of Innovative firms in the ICT cluster with R&D activities.

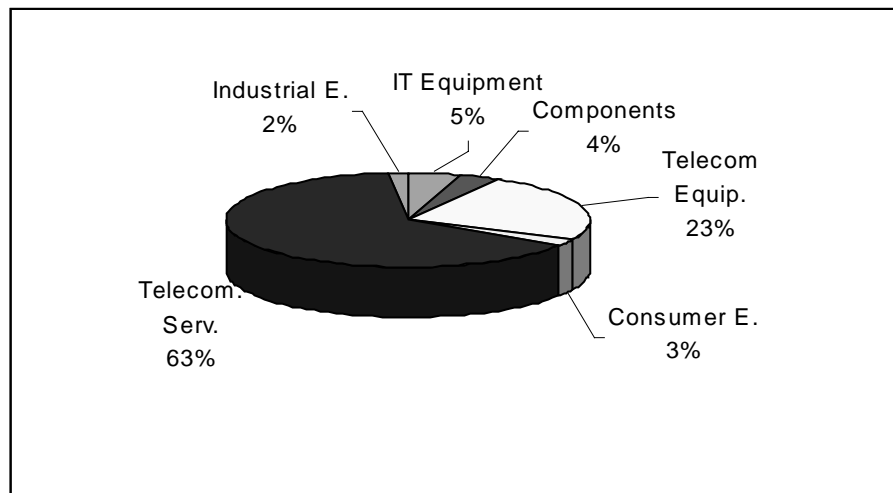


Source: COTEC (2000)

Innovation expenditure

The ICT cluster's innovation expenditure reached 1.224 Million Euros in 1998, whereas Telecom services' innovation expenditure represent more than 63 per cent of the total expenditure of the cluster, as it is shown in Figure 3.

Figure 3. Innovative expenditure of the ICT cluster by sub-industries.



Source: COTEC (2000)

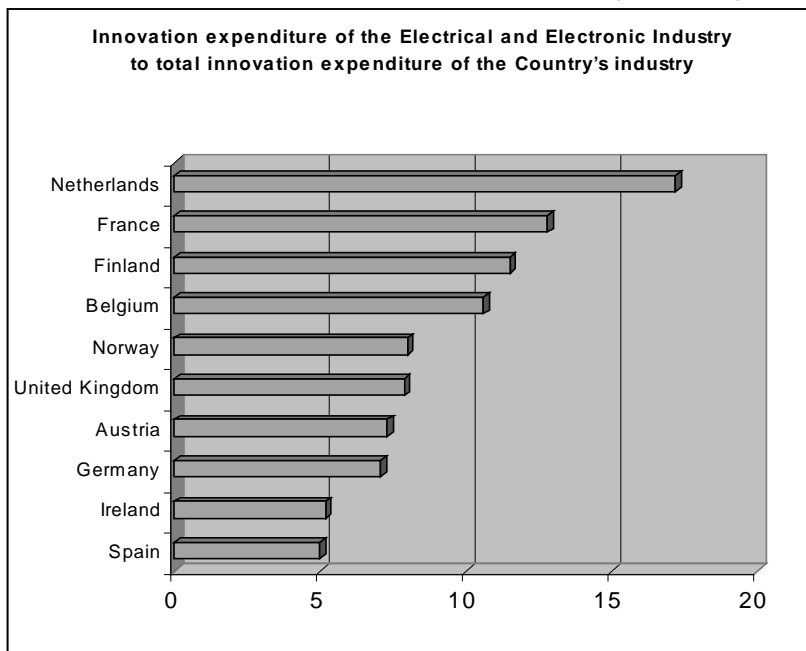
The high proportion of Telecommunication Services innovation expenditure can be easily explained when taking into account the composition of the innovative expenditure: most of it is due to the acquisition of high sophisticated telecommunication equipment with a high value in the market. As a result of this, the Telecommunication services firms show the higher innovation expenditure per firm, almost 7 times the average of the rest of the ICT industries considered in the cluster.

The ICT cluster is at the forefront of the Spanish economy in terms of innovation expenditure. This has been a common pattern in almost all developed countries as international reports such as the ICT Outlook conducted by the OECD has shown. In order to get a better picture of the Spanish ICT cluster in terms of innovation, some international references should be taken into account.

For international comparisons, the Eurostat statistics on the innovation expenditure of the Electric and Electronic industry in most of the EU countries (CIS II) will be used.

As Figure 4 show, the level of innovation expenditure of the Spanish ICT cluster is below the average of most European countries and only similar to Ireland.

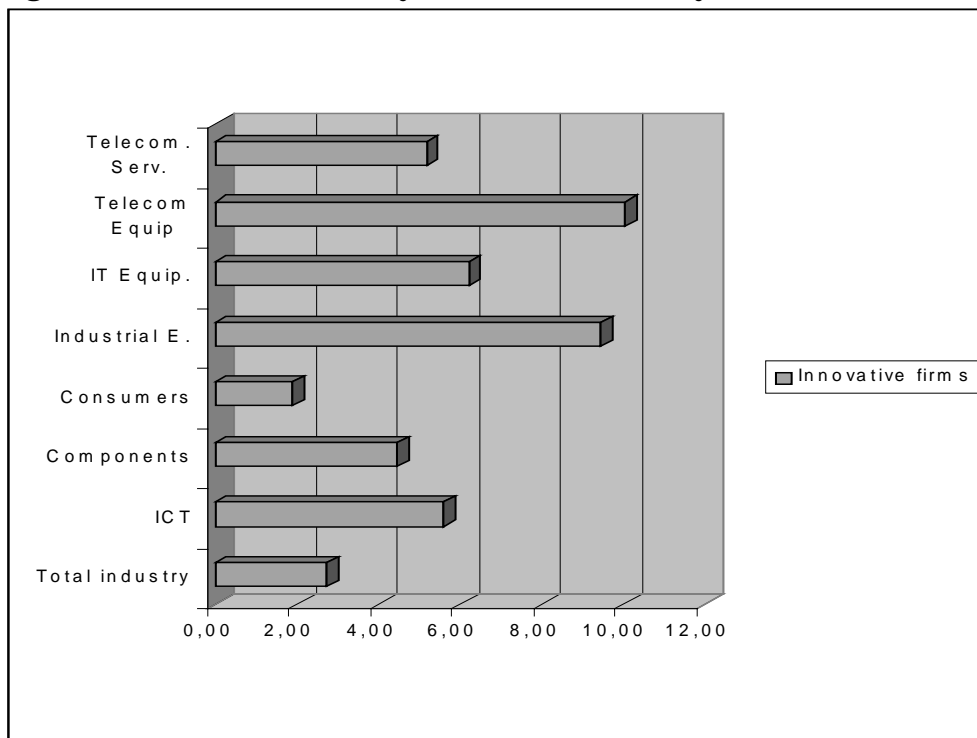
Figure 4. Innovation expenditure of the Electrical and Electronic Industry to the whole Businesses innovation expenditure by country.



Source: COTEC (2000) based on Eurostat. New Cronos Database. January 2000.

In terms of innovation intensity of the innovative firms, that is, innovation expenditure to turnover, the ICT sub-clusters are far above from the Spanish average, with the sole exception of the Consumer electronics, as it is shown in Figure 5.

Figure 5. Innovation intensity in the ICT cluster by sub-industries.



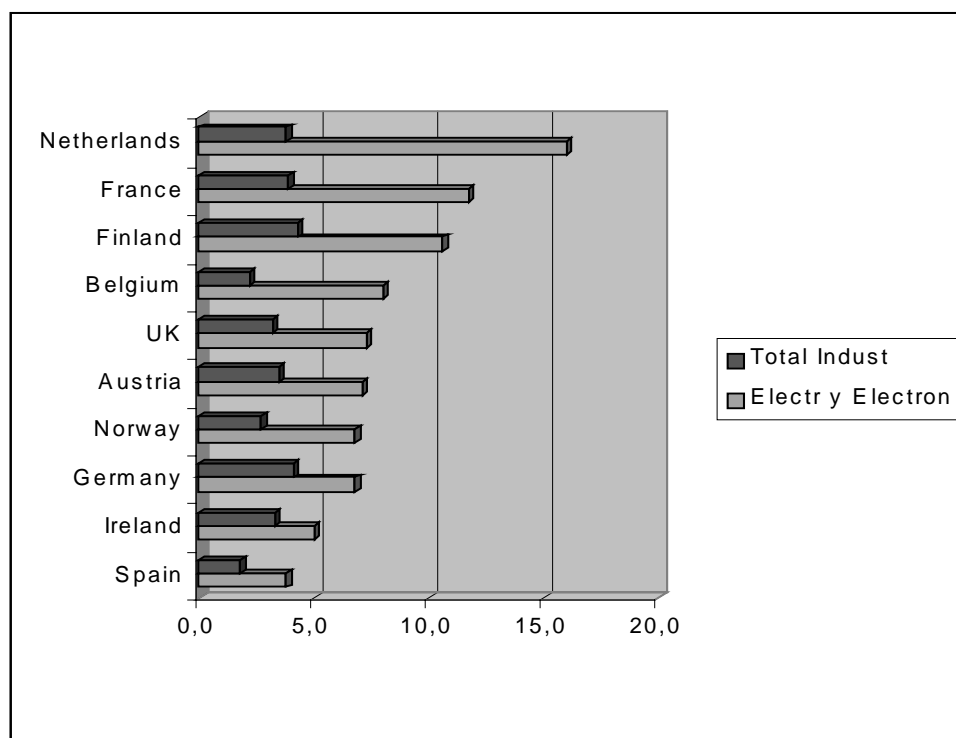
Source: COTEC (2000)

The Eurostat provides information on the innovation intensity of the Electrical and Electronic equipment and the Telecommunication services. The results are plotted in Figures 6 and 7.

As it is shown, the innovation intensity of the ICT cluster (taking as a proxy measure the Electrical and Electronic industry) is always above the average of the Spanish business.

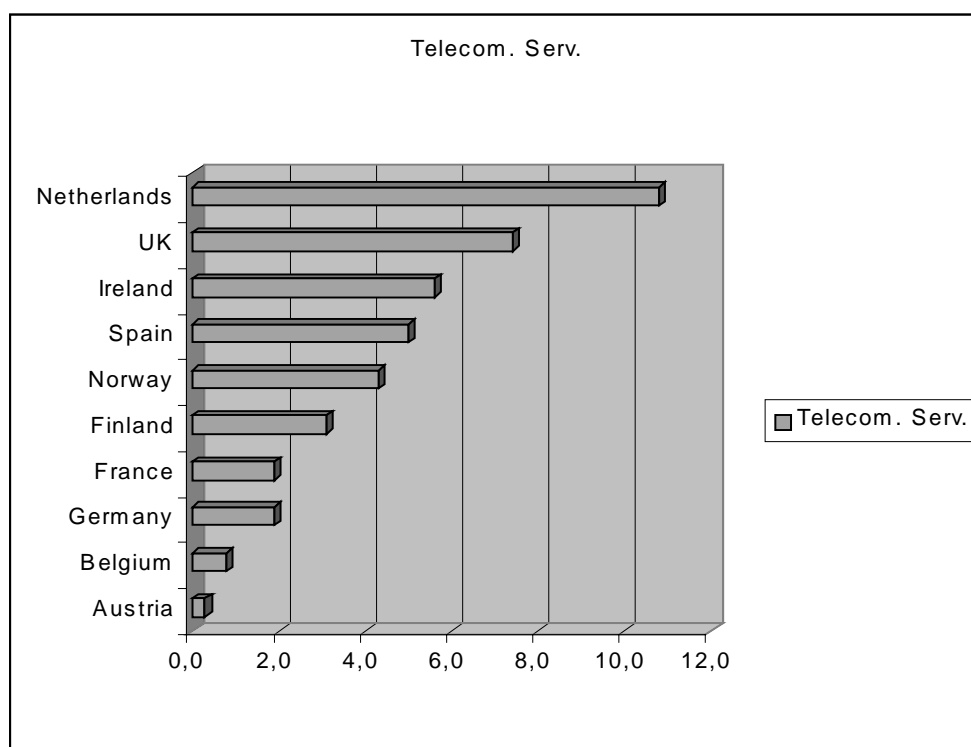
Although the results show Spain in the last place when considering the Electrical and Electronic Industry, the results are good when we consider just the Telecommunication Services, which is just the result of the competitive situation of this Spanish sub-cluster in relation to the main European competitor countries. However, it should be stressed that the Spanish data for the Telecom. Services corresponds to 1998, while the rest is from 1996, which can lead us to some misleading conclusions.

Figure 6. Innovation intensity of the Electrical and Electronic Industry in the U.E. 1996.



Source: COTEC (2000) based on Eurostat. New Cronos Database. January 2000.

Figure 7. Innovation intensity of the Telecommunication Services in the U.E. 1996.



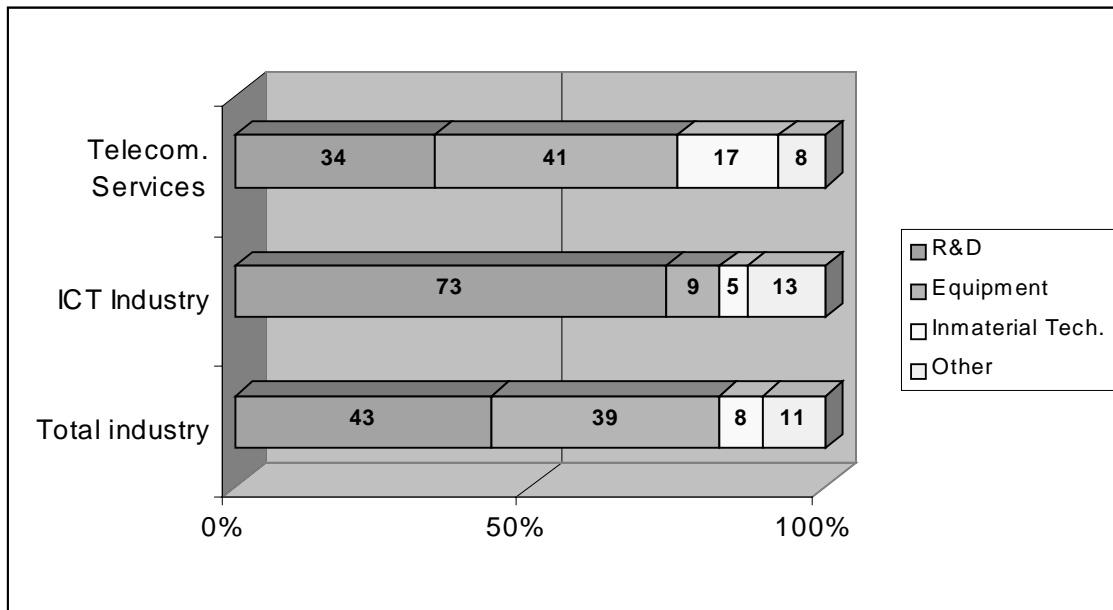
Spain (1998 data)

Source: COTEC (2000) based on Eurostat. New Cronos Database. January 2000.

Regarding the composition of the innovation expenditure, we clearly can see differences both between the ICT cluster and the average of the Spanish businesses and between the ICT industries and the ICT services (Telecommunication).

As Figure 8 shows, R&D accounts for 73 per cent of the total innovation expenditure in the Industrial side of the ICT cluster (that is, excluding Telecom. services), while the average of the Spanish Businesses is 43 per cent. In the Telecommunication Services, as was previously stated, the main part of the innovation expenditure is due to the acquisition of new equipment, mainly from the Telecom Equipment industry, which in average has more unitary value.

Figure 8. Composition of the Innovation expenditure by ICT services and manufacturers.

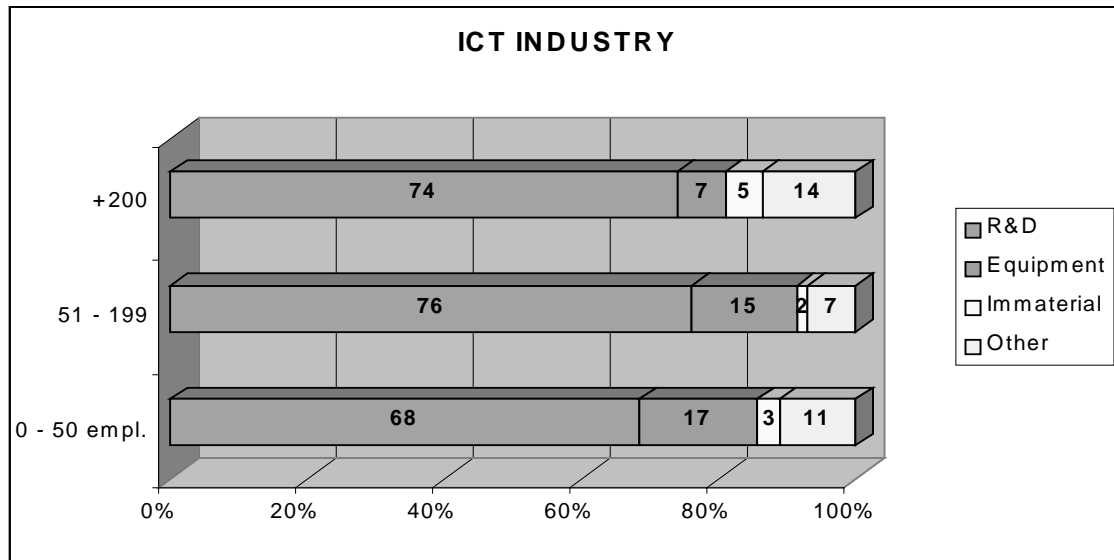


Other: Design, Training and Marketing activities linked to Innovative activities.
Source: COTEC (2000)

There are also important differences by size of the firm. As Figure 9 shows, the acquisition of new equipment is more important for the small firms with less than 50 employees than for those with more than 200 employees, while for big firms the acquisition of disembodied technology, such as patents, has more weight in the total innovation expenditure than for the small firms.

As a general trend, less innovative firms, as is usually the case of smaller firms devote more resources to the acquisition of external technology than for the internal generation of technology through R&D activities. However, the results obtained for the smaller firms in the Spanish ICT cluster reveal one significant feature of the cluster: even small firms devote a great part of their innovative resources to R&D activities.

Figure 9. Breakdown of innovation expenditure in the ICT industries (excl. Telecom. Services) by size.

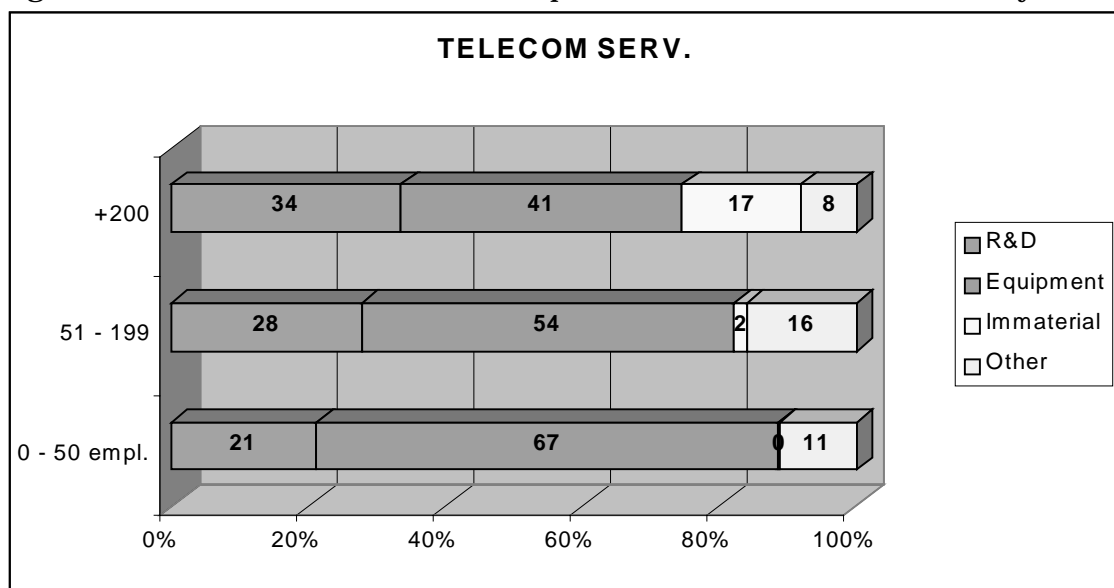


Source: COTEC (2000)

In the case of the Telecommunication services, the differences between firms by size are even more clear. As Figure 10 shows, small firms with less than 50 employees devote 67 per cent of their innovation expenditures to the acquisition of new equipment, while this proportions falls down to 41 in the firms with more than 200 employees.

Another significant difference is related to the proportion of innovation expenditures due to disembodied technology (patents, trademarks, etc). In the case of the big firms with more than 200 employees, this accounts for 17 per cent while for the smaller firms, hardly reaches 0,1 per cent.

Figure 10. Breakdown of innovation expenditure in the Telecom. Serv. by size.



Source: COTEC (2000)

New products and new services

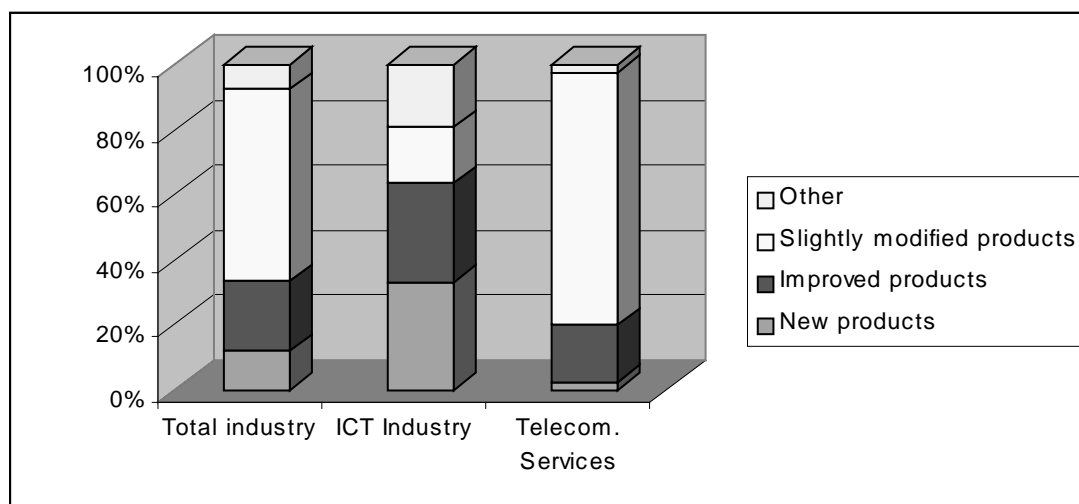
All the previous analysis focuses mainly on the input side, that is, what are firms investing in order to obtain new products and services and to introduce new processes. But the success of those efforts need to be assessed using some output measures. In this sense, the SIS collects information on two different indicators:

- Percentage of turnover due to new products or services
- Percentage of exports due to new products or services

Regarding the first one, more than a half of the total ICT Cluster turnover (excluding services) is due to new or improved products, while the average of the Spanish businesses is only 30 per cent, as plotted in Figure 11. It seems that the speed of change of the ICT cluster, makes the three year time-span used for the indicator, meaningless for the cluster, and thus, that a shorter period of time would be more appropriate for this cluster.

In the case of the Telecom Services, the share of new services accounts for less than 20 per cent. Traditional Telecom services continue to account for the lion's share in the total turnover of the sub-cluster.

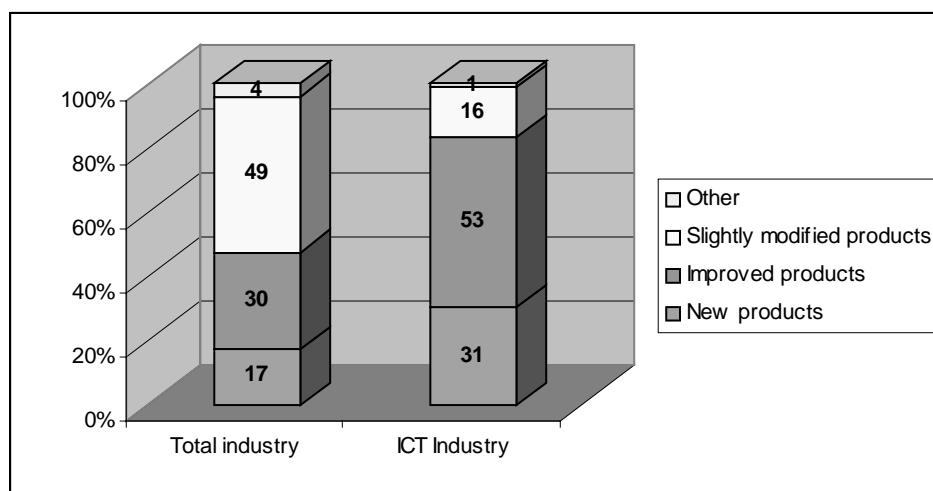
Figure 11. Breakdown of Turnover due to new and improved products and services in the ICT cluster. 1998.



Source: COTEC (2000)

Regarding the impact of innovation in the exports volume of the cluster, we can clearly see that more than 80 per cent of the exports of the ICT cluster is due to new or significantly improved products, while the average of the Spanish businesses is below 40 per cent, as Figure 12 shows.

Figure 12. Breakdown of Exports due to new and improved products and services in the ICT Cluster (Excl. Telecom. Services). 1998.



Source: COTEC (2000)

Multinational versus domestic firms

It is expected to find differences between multinationals and domestic firms, and this is specially true when dealing with innovative activities. Next we breakdown the key data already presented by domestic and multinational firms. Industrial electronics has been excluded from the analysis.

Considering the ICT cluster (excluding Telecom. Services), the total turnover of the 48 multinational firms triple that of the 256 domestic firms. That is to say that only 1 out of 6 firms in the ICT Cluster is multinational but their turnover accounts for 3 out of 4 parts of the total ICT turnover.

In the Telecom Services sub-cluster the situation is just the opposite. Only 8 firms are multinationals but they account for less than 1 per cent of the total sub-cluster turnover.

Table 1. Key data on the ICT cluster. Domestic vs Multinational firms.

	Total Turnover in Mill. Euro		Number of innovative firms		Innovation Expenditure by firm in thousand Euro		Innovation intensity		% Turnover due to new and improved products	
	Multinat.	Domestic	Multinat.	Domestic	Multinat.	Domestic	Multinat.	Domestic	Multinat.	Domestic
	Total Industry	86384	134268	921	15718	2450,09	242,89	2,6	2,8	43,9
IT Equipment	776	126	5	36	8662,99	359,27	5,6	10,3	97,7	74,3
Components	477	573	32	134	437,99	245,29	2,9	5,7	61,1	57,1
Consumer and Telecom Equip.	3670	903	11	89	25016,31	505,59	7,5	5,0	72,0	53,2
Telecom. Services	102	14958	8	87	794,09	8898,02	6,2	5,2	21,2	19,8

Regarding the innovation expenditure and excluding Telecom Services from the analysis, multinational firms account for 78 per cent of the total ICT cluster innovation expenditure. Innovation intensity is also higher among multinational firms with the exception of the IT Equipment and Electronic components where the domestic intensity is above that of the multinationals.

In the Telecom Services sub-cluster, although domestic firms account for nearly 99 per cent of the total innovation expenditure, their innovation intensity is 1 point below the multinationals'.

Considering the average expenditure by firm, we can clearly see that multinationals expend 20 times more than domestic firms, reaching 50 times in the case of Telecom. Equipment sub-cluster.

Once again, the exception is the Telecom Services sub-cluster whereas domestic firms expend, in average, 11 times more than multinationals do.

Finally, regarding the outcome of those innovative efforts, the percentage of turnover due to new and improved products in the multinationals is fairly higher than the same ratios in the domestic firms.

As a conclusion, it can be said that there are significant differences between domestic and multinational firms. The latter devote more resources to innovation activities and, as a result, obtain better results in terms of sales of new and improved products.

4. Conclusions

The ICT cluster plays an important role in the Spanish economy. In 1998, nearly 5 per cent of the national GDP was due to this cluster, and this percentage was even higher when we considered only the ICT manufacturers (that is, excluding services).

Innovation is one of the key factors supporting the competitiveness of the ICT firms, and it seems clear that the ICT cluster is in the forefront of the Spanish economy in terms on number of innovative firms, overall innovation expenditure, innovation intensity, as well as innovation outputs.

The SIS provides a good basis for the analysis on innovation in the cluster that should be further exploited, by including in the analysis some other variables. Some examples are:

- R&D and Innovation Collaborative agreements
- Patents
- Non-technological innovations
- New technologies in manufacturing
- Objectives and obstacles

The analysis should also be completed with other sources of information, such as R&D survey as well as with international comparisons when possible. This will be done during the next months.

5. References

- ANIEL (1999) Informe del sector Electrónico y de Telecomunicaciones 1998. Madrid.
- ARUNDEL, A (1996). *Entreprise strategies and barriers to innovation*. International Conference on Innovation measurement and policies. Luxembourg. Mimeo.
- BROUWER, E.; DEN HERTOOG, P. (2000) *Key data on the Dutch information and Communication Cluster*. Mimeo.
- CALVERT, J.; IBARRA, C.; PATEL, T & PAVITT, K. (1996). *Innovation output in European Industry: Analysis from CIS*. International Conference on Innovation measurement and policies. Luxembourg. Mimeo.
- CHAMINADE, C. (1999) *Innovation processes and knowledge flows in the Information and Communications Technologies (ICT) cluster in Spain* in OECD Boosting Innovation. The Cluster Approach.
- COTEC (2000) Innovación en las TIC. Madrid: COTEC. (To be published).
- EITO (1999) European Information Technology Observatory 99.
- EUROSTAT (2000) *New Cronos Data Base*.
- EVANGELISTA, R; SANDVEN, T.; SIRILLI, G. Y SMITH, K. (1996). *Measuring the cost of innovation in European Industry*. International Conference on Innovation measurement and policies. Luxembourg. Mimeo.
- ILKOVITZ, F.; MOGESEN, U. (1999) *Tecnologías de la Información y las Comunicaciones en Europa. Problemas y Desafíos* in Papeles de Economía Española, nº 81, pp. 21-23.
- INE (1999) Encuesta sobre innovación tecnológica en las empresas. 1998. Madrid: INE.
- LAZARO, M. (1994) *Tecnologías de la información y de las comunicaciones: presente y futuro* in Economía Industrial, marzo-abril, pp. 35-42.
- OECD (1996, 2nd edition) OECD Proposed Guidelines for collecting and interpreting technological innovation data - the Oslo Manual. Paris.
- OECD (2000) OECD Information Technology Outlook 2000. ICT's, E-commerce and the Information Economy. Paris.

SANCHEZ, M.P. ; CHAMINADE, C. (1999a) El proceso de innovación en las empresas españolas. Análisis de las encuestas de innovación. Colección Estudios nº 14. Madrid: Fundación Cotec.

SANCHEZ, M.P. ; CHAMINADE, C. (1999b) *Instrumentos de Medición de la actividad innovadora. El papel de las encuestas de innovación. Resultados del caso español* en COTEC Informar sobre Innovación. Madrid: APIE-COTEC.

SEDISI (1999) Las Tecnologías de la información en España. 1998. Madrid.