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R&D investment by the 50 largest companies in Catalonia

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FOREWORD

In recent years the promotion of investment in R&D and Innovation has become a priority for European governments, and this is also true when considering the Government of Catalonia. Within a changing global context, Catalan SME's and large companies alike face the daily challenge of adapting to the new scenario if they are to guarantee their competitiveness and their survival, and competitiveness often goes hand-in-hand with greater investment in R&D.

In line with this, over recent years the Government of Catalonia has implemented a whole series of initiatives and plans of action to make Catalonia a point of reference with regard to R&D investment in Spain and Europe. R&D and Innovation policy in Catalonia is therefore framed within the guidelines included in the *Pla de Recerca i Innovació 2005-2008* (2005-2008 Research and Innovation Plan), the Government of Catalonia's *Pla de Govern* (Government Plan) and the *Acord Estratègic per la internacionalització, la qualitat de l'ocupació i la competitivitat de l'economia catalana* (Strategic Agreement for the internationalisation, quality of employment and competitiveness of the Catalan economy).

In addition to the above, the process for drafting the *Pacte Nacional per a la Recerca i la Innovació* (National Research and Innovation Agreement) has also recently been initiated, with the aim of providing a long-term agreement which will enjoy of a broad consensus between social, economic and political agents to make scientific research and technological innovation priority areas for the progress of Catalonia.

Furthermore, the common denominator linking the objectives of European countries continues to be the improvement of competitiveness in order to meet the objectives established by the Lisbon Agenda. Clearly, one of the means of achieving this must necessarily be a commitment to research, development and innovation in companies.

In order to evaluate the effectiveness of the actions implemented, a series of indicators will be produced on a regular basis to ascertain the amount and consequences of this investment in R&D and Innovation by companies in their business sector and the economy in general. In respect of this, the aim of this study is to describe the current situation with regard to the Catalan R&D and Innovation conducted by large Catalan companies, with the ultimate objective of establishing a ranking of the top 50 large Catalan companies in terms of R&D.

Our hope is that this study will become another step towards, on the one hand, the promotion of investment in R&D and Innovation in Catalan companies and, on the other, support for the design of public policies that allow to those companies to improve their competitiveness.

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INTRODUCTION

In July 2006, CIDEM instigated a study about the R&D investment of the 50 largest companies in Catalonia. A team of university lecturers from the Department of Economics and Business Organization at the University of Barcelona and the Department of Organization, Business Management and Product Design at the University of Girona was commissioned to conduct the study. Fieldwork took place between September 2006 and May 2007.

R&D scoreboards were used as a starting point. These are rankings of large companies' investment in R&D which have been used and disseminated by the European Union since 2003. This report provides data concerning the R&D conducted by the 50 largest companies in Catalonia for the period 2003 to 2005. This period is the same as that covered by the EU's Industrial R&D Investment Scoreboards published to date, resulting from collaboration between two general management bodies of the European Commission: the Directorate-General for Research (DG-RTD) and the Joint Research Centre (DG-JRC).

The document we present here provides a view of R&D in large Catalan companies, information which has never been previously published. The information that has been collected and analysed gives us a first look at the situation and helps us to understand what is actually happening in an area as relevant as that of R&D investment by Catalan companies. In addition, there may also be aspects of the qualitative analysis that may be of some use in the design of support policies.

As this is the first time the R&D of large Catalan companies has been approached, we thought it would be appropriate to complement the data typical of scoreboards with additional information of a more general type regarding the companies themselves, in order to provide more context for the data retrieved from the information request forms. In accordance with CIDEM, twenty-five face-to-face interviews and twenty-five telephone interviews were conducted. Section 3.3 of the study presents a sector overview, including the results of these interviews.

Furthermore, we should also point out that there is a specific section analysing La Conca Central del Llobregat. This analysis formed part of the requirements of the work commissioned to CIDEM in order to evaluate the degree to which R&D activities are present among large companies in this geographical area. The results are presented in section 3.2.6.

In addition, despite the obvious difficulties of finding time for the study in their agendas, we would like to state that the degree of availability, co-operation and support received from companies has been extremely high. We would therefore like to express our gratitude, first and foremost, to all of the people who have made it possible for us to have this data: general managers, R&D managers or finance managers, whichever is the case. We would

also like to thank the secretaries of these managers for their patient work that allowed us to conduct our research.

With regard to CIDEM, we would like to express our most sincere gratitude to the people who have participated in guiding and monitoring the study: Raül Blanco, who was head of studies and publications until February 2007, Inma Rodríguez, who succeeded him in this position, and Marta Navarro, one of the experts from this department.

This document provides a summary of most of the data obtained. There are numerous initiatives, singularities, considerations, etc. that for reasons of space or maintaining anonymity are not included. We would like to take this opportunity to express our apologies to the companies for this, and our hope that they can understand the limitations inherent in a study of these characteristics which attempts to summarise a large volume of data.

Barcelona / Girona, October 2007

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R&D IN LARGE-SCALE EUROPEAN COMPANIES A SUMMARY OF AVAILABLE DATA

1.1. INNOVATION AND COMPETITIVENESS

In the European Union, innovation and R&D are at the centre of concerns relating to improved competitiveness. The agreements of the Lisbon European Council[1] (March 2000) are a demonstration of this and propose some very ambitious objectives in this regard: investment in R&D to reach 3% of GDP by 2010, under the slogan «towards a Europe of innovation and knowledge». Since 2000, these priorities of «the Lisbon Agenda» have marked the discourse and deployment of measures relating to improved competitiveness in the European Union.

Within this context, one area which has received significant impetus has been that of producing indicators for the innovative activity of companies and territories and their systems of innovation. Despite the fact that innovation indicators are the cause of great difficulties, efforts to unify and aggregate indicators have produced results and we now have annually-updated scoreboards, the representative of which in the case of Europe being the European Innovation Scoreboard.

Advances in the field of indicators have not taken place only within the European Union. On the contrary, they are preceded by the OECD's Frascati Manual[2] and Oslo Manual. In their later editions these manuals played a key role in measuring R&D and innovation. In recent years, statistics for R&D and innovation have been consolidated in OECD countries and, thanks to the work carried out by the OECD itself in aggregating results (joined by Eurostat from the Nineties onwards), we today have an exhaustive set of indicators which allow us to make comparisons that would have been considered unthinkable some years ago.

The indicators proposed in the Frascati and Oslo manuals and in the scoreboards are the starting point for this study. The aim is to apply these tools to measure R&D and innovation in large Catalan companies to provide the foundations for the designing of policies which will allow them to improve their competitiveness.

1. An extraordinary meeting of the European Council was held in Lisbon on 23rd and 24th March. See http://europa.eu/scadplus/leg/es/cha/c10241.htm [Query: 2nd April 2007].
2. Frascati Manual 2002- ISBN 84-688-2888-2 - © OECD 2003.

1.2. R&D SCOREBOARDS

The production of scoreboards for innovation demonstrates the broad influences of its importance. The European Innovation Scoreboard, for example, includes indicators of areas such as: the level of training in the population, patents, R&D expenditure, the percentage of innovative SME's, the weight of new products in sales figures, etc. The Trendchart website (Innovation Policy in Europe)[3] displays the set of initiatives and perspectives which gather and treat data for analysing the level of innovation in Europe and its countries. Here, too, references to innovation are becoming increasingly broader in scope and not restricted solely to technological innovation.

In the case of Spain, in addition to the data and publications provided by the INE (National Statistics Institute), we should also mention the annual report produced by COTEC, which has become a reference in the field. With regard to Catalonia, two reports stand out which were recently published by the Department for Innovation, Universities and Enterprise: «La situació de la innovació a Catalunya (The situation with regard to innovation in Catalonia)»[4] and «La innovació i l'R&D industrial a Catalunya (Industrial innovation and R&D in Catalonia)».[5] The former was published by CIDEM, within its collection of studies, and the latter by the General Secretariat for Industry, within the collection of Papers on Industrial Economics. Within a globalised context, R&D and innovation policy requires new indicators. The R&D Investment Scoreboards for large companies are intended to monitor the evolution of R&D expenditure by large European companies, detect trends and compare the amount of this expenditure with that of other large international companies.

There are currently different R&D Investment Scoreboards, such as, for example, the R&D[6] Investment Scoreboard, with a worldwide scope, and the EU Industrial R&D Scoreboards.[7] These are published by the European Union and provide a series of basic data relating to the European companies or those in other parts of the world which invest most in R&D.[8] In addition to the specific variables of R&D, investment in R&D, financing and personnel, the variables used to compile the rankings and construct ratios are as follows: company sales, the total workforce of the company, profits and total company investments. At the time of writing, there are no R&D investment rankings exclusively for Spanish companies.

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3. See http://trendchart.cordis.lu/ [Query: 2nd April 2007].
4. Busom, Isabel (coordinator): *La situació de la innovació a Catalunya*. Collection of studies. Ministry for Work and Industry, 2006.
5. Solà, Joaquim; Saéz, Xavier; Termes, Montserrat: «La innovació i l'R&D industrial a Catalunya», *Industrial Economics Papers*, no. 23. Department for Work and Industry, 2006.
6. See methodology note on the concept of «Investment in R&D» and comparisons (appendix 5.2).
7. See http://iri.jrc.es/research/Scoreboards.htm [Query: 2nd April 2007].
8. *R&D Investment Scoreboards* only include available information. That is, companies that do not make their R&D data public are not included.

1.3. THE MAIN RESULTS OF R&D INVESTMENT SCOREBOARDS

With respect to the European Scoreboards mentioned in the previous section, Table 1 includes some of the aggregated results from the 2005 analysis.[9] Specifically, it compares the results between European and non-European companies and provides evidence of some significant differences in the behaviour of these two groups.

The table compares the group of the 338 large European companies with the same minimum threshold of R&D investment as the group of 1,000 largest non-EC companies that have invested most in R&D (24.91 million euros in the 2005 financial year).

Table 1. Overall results of company R&D (2005)

	Non-EU1000	EU338[10]	EU1000
Investment in R&D (thousand million euros)	257.7%	106.6%	112.9%
Variation compared to previous year	7.7%	5.3%	5.3%
Net sales (thousand million euros)	6,566.0%	3,624.96%	4,507.0%
Variation compared to previous year	9.5%	6.5%	7.0%
Investment in R&D / Net sales	3.9%	2.9%	2.5%
Changes in operating profit compared to previous year	11.8%	20.1%	21.2%

Source: EU Industrial R&D Investment Scoreboard 2006.

Table 2 presents the 50 companies that have invested most in R&D around the world in 2005. The company with the greatest variation in terms of R&D compared to the previous year is the European company Bae Systems, and the American company Ford Motors is the company that has invested most in R&D in the world.

If we analyse by business sector, we find 15 industries represented, although most companies, almost 60%, belong to just three sectors: automotive and components, pharmacy and telecommunications equipment. Similarly, the 50 companies that invest most in R&D in the world belong to 11 different countries, although almost 70% of these companies are from either the United States, Japan or Germany. Of the 50, 18 companies have their head offices in European Union countries, two in Switzerland, 18 in the United States, in Japan and two in South Korea.

9. In Table 1, calculations are made using values from the 2005 financial year. Calculations of ratios do not include all companies as only those companies are used where complete information is available.
10. These 338 companies are included within the EU 1000. The Scoreboard makes one column of the 338 due to the fact that they share the same R&D investment threshold as the 1000 non-European companies (24.9 one million euros in 2005).

Table 2. **Top 50 ranking companies in the world for R&D investment (2005)**

	Company	Sector	Country	Investment in R&D (millions €)	Variation compared to the previous year (%)
1	Ford Motor	Automotives and components	USA	6,781.92	8.1
2	Pfizer	Pharmacy	USA	6,308.88	-3.1
3	General Motors	Automotives and components	USA	5,679.86	3.1
4	Daimler Chrysler	Automotives and components	Germany	5,649.00	-0.2
5	Microsoft	Software	USA	5,581.52	6.5
6	Toyota Motor	Automotives and components	Japan	5,423.93	10.7
7	Johnson & Johnson	Pharmacy	USA	5,350,94	21.3
8	Siemens	Electrical equip. and components	Germany	5,155.00	1.8
9	Samsung Electronics	Electrical equipment	South Korea	4,612.61	12.2
10	GlaxoSmithKline	Pharmacy	UK	4,564.13	10.5
11	IBM	IT services	USA	4,559.15	4.1
12	Intel	Semiconductors	USA	4,361.62	7.7
13	Novartis	Pharmacy	Switzerland	4,108.15	15.2
14	Volkswagen	Automotives and components	Germany	4,075.00	-2.1
15	Matsushita Electric	Consumer products	Japan	4,056.61	-8.2
16	Sanofi-Aventis	Pharmacy	France	4,044.00	2.1
17	Nokia	Telecommunications equipment	Finland	3,978.00	3.8
18	Sony	Consumer products	Japan	3,819.68	5.9
19	Roche	Pharmacy	Switzerland	3,669.70	12.0
20	Honda	Automotives and components	Japan	3,359.70	4.2
21	Merck	Pharmacy	USA	3,262.10	-4.0
22	Motorola	Telecommunications equipment	USA	3,119.68	20.3
23	BMW	Automotives and components	Germany	3,115.00	10.5
24	Hewlett-Packard	IT equipment	USA	2,958.61	-0.5
25	Robert Bosch	Automotives and components	Germany	2,931.00	1.1
26	Hitachi	IT equipment	Japan	2,909.53	4.2
27	General Electric	Industry in general	USA	2,903.51	10.8
28	AstraZeneca	Pharmacy	UK	2,854.51	-11.1
29	Nissan Motor	Automotives and components	Japan	2,859.75	12.4
30	Cisco Systems	Telecommunications equipment	USA	2,816.19	4.1
31	Ericsson	Telecommunications equipment	Sweden	2,729.95	16.5
32	Eli Lilly	Pharmacy	USA	2,564.84	12.4

... /...

	Company	Sector	Country	Investment in R&D (millions €)	Variation compared to the previous year (%)
33	Toshiba	IT equipment	Japan	2,499.62	3.4
34	EADS	Aerospace and defence	The Netherlands	2,367.00	3.1
35	Philips Electronics	Consumer products	The Netherlands	2,337.00	-7.8
36	Wyeth	Pharmacy	USA	2,330.77	11.7
37	Bristol-Myers-Squibb	Pharmacy	USA	2,327.89	9.8
38	NTT	Telecommunications	Japan	2,284.61	-10.4
39	Renault	Automotives and components	France	2,264.00	15.5
40	Peugeot	Automotives and components	France	2,151.00	1.6
41	BAE Systems	Aerospace and defence	UK	2,108.88	30.5
42	Canon	Electronic equipment	Japan	2,057.65	4.1
43	Hyundai Motor	Automotives and components	South Korea	1,982.69	21.9
44	NEC	IT equipment	Japan	1,977.72	7.3
45	Amgen	Biotechnology	USA	1,961.67	14.1
46	Bayer	Chemical	Germany	1,866.00	-21.5
47	Boeing	Aerospace and defence	USA	1,869.27	17.4
48	Delphi	Automotives and components	USA	1,865.03	4.8
49	Alcatel	Telecommunications equipment	France	1,792.00	15.1
50	Finmeccanica	Aerospace and defence	Italy	1,746.00	20.1

Source: «The 2006 EU Industrial Investment Scoreboard» and own data.

Table 3 shows the 50 European companies that invested most in R&D according to the 2006 EU Industrial R&D Investment Scoreboard. Of these, 18 also belong to the group of 50 with most R&D investment worldwide. In Europe, DaimlerChrysler invests most in R&D and UCB is the company that increased its R&D investment by the largest amount between 2004 and 2005.

In 2005, the proportion of companies in sectors where there is high growth, such as IT programs and services, pharmaceutical products and biotechnology, has slightly increased.

Furthermore, as is the case with the world scoreboard, there is a strong concentration by sector; 60% of European companies on the list are from the sectors automotive and components, pharmacy and aerospace and defence (this sector is different on the world scoreboard). The countries with most representatives among the 50 European companies that invest most in R&D are Germany, France and the UK (74% of the total).

Table 3. **Top 50 ranking European companies for R&D investment (2005)**

	Company	Sector	Country	Investment in R&D (millions €)	Variation compared to the previous year (%)
1	DaimlerChrysler	Automotives and components	Germany	5,649.00	-0.2
2	Siemens	Electrical equip. and components	Germany	5,155.00	1.8
3	GlaxoSmithKline	Pharmacy	UK	4,564.13	10.5
4	Volkswagen	Automotives and components	Germany	4,075.00	-2.1
5	Sanofi-Aventis	Pharmacy	France	4,044.00	2.1
6	Nokia	Telecommunications equipment	Finland	3,978.00	3.8
7	BMW	Automotives and components	Germany	3,115.00	10.5
8	Robert Bosch	Automotives and components	Germany	2,931.00	1.1
9	AstraZeneca	Pharmacy	UK	2,864.51	-11.1
10	Ericsson	Telecommunications equipment	Sweden	2,729.95	16.5
11	EADS	Aerospace and defence	The Netherlands	2,367.00	3.1
12	Philips Electronics	Consumer products	The Netherlands	2,337.00	-7.8
13	Renault	Automotives and components	France	2,264.00	15.5
14	Peugeot	Automotives and components	France	2,151.00	1.6
15	BAE Systems	Aerospace and defence	UK	2,108.88	30.5
16	Bayer	Chemical	Germany	1,886.00	-21.5
17	Alcatel	Telecommunications equipment	France	1,792.00	15.1
18	Finmeccanica	Aerospace and defence	Italy	1,746.00	20.1
19	Boehringer Ingelheim	Pharmacy	Germany	1,360.00	10.4
20	Fiat	Automotives & components	Italy	1,318.00	
21	STMicroelectronics	Semiconductors	The Netherlands	1,317.39	7.3
22	Infineon Technologies	Semiconductors	Germany	1,243.00	8.6
23	Volvo	Commercial vehicles and lorries	Sweden	1,124.98	18.0
24	SAP	Software	Germany	1,088.63	6.7
25	BASF	Chemical	Germany	1,086.30	-7.4
26	BT	Telecommunications	UK	1,058.08	39.3
27	Schering (actual. Bayer)	Pharmacy	Germany	989.00	6.0
28	Unilever	Food	UK	953.00	-8.4
29	AKZO Nobel	Chemical	The Netherlands	837.00	1.3
30	Valeo	Automotives and components	France	779.00	11.3
31	France Telecom	Telecommunications	France	716.00	27.0
32	Merck	Pharmacy	Germany	713.00	19

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	Company	Sector	Country	Investment in R&D (millions €)	Variation compared to the previous year (%)
33	Novo Nordisk	Pharmacy	Denmark	681,73	16.8
34	TOTAL	Petroleum production	France	676,00	6.5
35	Continental	Automotives and components	Germany	590,40	11.4
36	Michelin	Automotives and components	France	565,00	-16.1
37	ZF	Automotives and components	Germany	559,00	7.4
38	MAN	Industrial machinery	Germany	547,00	36.8
39	Telefonica	Telecommunications	Spain	544,00	18.0
40	Schneider	Electrical equip. and components	France	542,10	1.3
41	Rolls-Royce	Aerospace and defence	UK	512,30	24.8
42	UCB	Pharmacy	Belgium	511,00	41.3
43	Thales	Aerospace and defence	France	503,60	15.5
44	Royal Dutch Shell	Petroleum production	UK	498,47	6.3
45	L'Oreal	Cosmetic products	France	496,20	-2.1
46	Royal Bank of Scotland	Banking	UK	478,83	8.6
47	Solvay	Chemical	Belgium	477,00	11.7
48	SAFRAN	Aerospace and defence	France	470,00	
49	ALTANA	Pharmacy	Germany	464,96	4.5
50	Deutsche Telecom	Telecommunications	Germany	433,00	-0.2

Source: «The 2006 EU Industrial Investment Scoreboard» and own data.

1.4. THE SCOREBOARDS AND THE AIM OF THIS STUDY

In Catalonia, in recent years the situation with regard to R&D has become the object of special attention in the analysis of company competitiveness. According to INE statistics, in 2005 R&D expenditure in Catalonia represented 1.36% of GDP. The weighting of R&D conducted by the companies in comparison with the total was 63%, whilst the average for Spain is 53.8%.

R&D projects in Catalonia to which we have referred previously demonstrate, among other things, that there has been a gradual increase in endeavour with regard to R&D innovation, particularly in companies with high or medium-high intensity in technology.[11]

11. Busom, Isabel (coordinator). «La situació de la innovació a Catalunya». CIDEM collection of studies.

Notwithstanding this, there is a need for continually increased assessment of R&D investment in the business sector in the coming years.[12]

Current regional, national and European company rankings tell us which companies have the highest turnover or capitalisation, but they rarely reflect R&D investment or provide a measure of how large companies compare in terms of R&D.

The aim of this study is to gather information regarding R&D investment by the 50 largest companies based in Catalonia, and also to be able to make cross-sector and international comparisons in a similar way to the R&D scoreboards.

In this respect, the objective of the work commissioned to CIDEM was not to create a ranking in the strictest sense of the word, but rather to measure the importance R&D investment by the 50 largest companies based in Catalonia. It is for this reason an aggregated data analysis was opted for. Maintaining the confidentiality of the information provided by companies helped achieve a higher response rate, allowing us a fairly exhaustive view of the current situation.

A further aim of the study is to measure the growth in R&D investment in the largest Catalan companies and facilitate the monitoring of how this evolved for the period 2003 to 2005. Aware of the context in which the large companies in Catalonia find themselves today, the study analyses their investment in R&D and demonstrates the efforts they make, even if they start from initially relatively low levels of R&D.

Additionally, in 2005, the Government of Catalonia's Ministry for Work published the «Mapa dels sistemes productius locals industrials a Catalunya (Map of the local industrial production systems in Catalonia)»,[13] which identifies the sectors of metal products, automotives and plastic materials as the largest production systems in Catalonia, calculated by number of workers. Calculating by turnover, the chemical sector is also among the largest systems.

In conducting this study we analysed the 50 largest companies in Catalonia that agreed to provide data and be interviewed by those working on the study. These companies were categorised into six groups by sector: food, automotive, chemical, pharmacy, services and distribution, and the final one—which includes companies with diverse business activities—which we have called «other». The final distribution is of 8 companies per sector group, with the exception of the services and distribution sector, which contains 10 companies. Table 4 lists the 50 companies in alphabetical order. The following chapter explains the methodology employed in the selection of companies.

12. Solà, Joaquim; Sáez, Xavier, and Termes, Montserrat: «La innovació i l'R&D industrial a Catalunya», *Industrial Economics Papers*, no. 23. Department for Work and Industry, 2006.
13. Hernández Gascón, Joan Miquel: «Mapa dels sistemes productius locals industrials a Catalunya». *Industrial Economics Papers*, no. 21. Department for Work and Industry, 2005.

Table 4. **The 50 companies included in the study**

- Abertis
- Almirall
- Alstom transportes
- Alstom Power
- Basf Española SA
- Bayer Hispania SL
- Boehringer Ingelheim Esp.
- Clariant
- Cobega
- Colomer
- Corporación Alimentaria Guissona
- Caprabo
- CIRSA Business Corporation
- Damm
- Endesa
- Ercros
- Esteve (Grupo)
- Ferrer Internacional
- Ficosa Internacional
- Frape Behr
- Gas natural
- Grup Agbar
- Grup Areas
- Grup CH Werfen (Biokit)
- Grup Molins
- Grupo General Cable Sistemas SA
- Henkel
- Indo Internacional SA
- La Caixa
- Mango
- Nestlé
- Nissan Motor Ibérica SA
- Novartis
- Panrico
- Peguform
- Pepsico
- Pirelli neumáticos SA
- Puig Beauty & fashion group
- Sanofi Aventis SA
- Sara Lee Southern Europe (Bimbo)
- Schneider
- Seat SA
- Siemens VDO automotive
- Simon
- Solvay Ibérica
- Torras Papel
- Transports de Barcelona
- Tyco
- Unilever
- Uriach

2 METHODOLOGY

2.1. COMPANY SELECTION

The 50 largest companies based in Catalonia were selected in agreement with CIDEM from the following two databases:

— *Fomento de la Producción. España 30.000* (2005 edition)
— *Sistema de Análisis de Balances Ibéricos* (SABI, updated in 1989 and 1990)

The *Fomento de la Producción* (Promotion of Production) database includes data on the manufacturing sectors and SABI (System for Analysing Iberian Balance Sheets) covers all sectors of economic activity. In order to select companies from these databases, two lists of one hundred companies were created using the following selection criteria: over 250 workers and sales above 250 million euros.[14] During the selection process care was taken not to leave out any of the large business groups based in Catalonia, which are sometimes present in these databases in ways which make it difficult to identify the real size of the group: holdings, different group companies, etc. and possible incompatibilities in the selection of companies belonging to the same group of companies or holding.

Results were compared for each database and those companies were selected which were found to be in both, as well as those service companies that complied with the selection criteria. Information obtained from the two sources was later cross-referenced with the annual guide to the 5,000 largest Spanish companies produced by the magazine *Actualidad Económica*.[15]

This selection process meant that the 50 selected companies failed to be sufficiently representative with regard to sector. For this reason, together with CIDEM, it was agreed to extend the initial selection to obtain a minimum number of companies for each large sector of activity. This meant the inclusion in the study of two companies with a sales volume and/or number of workers which was lower than the initially established limit.

14. The first 50 companies with a higher number of workers and turnover were chosen from the two lists. This procedure was opted for due to the limitations of the selection filters that could be applied to the *Fomento de la Producción* database.
15. «Las 5000 mayores empresas españolas». *Actualidad Económica*, 26th October, 2006.

This procedure allowed us to compile a list of 70 companies (50 companies and 20 as reserves). The 70 companies sufficiently cover the different sectors.

They were classified into six large groups (Table 45 in Appendix 5.1 lists the sector codes):

— Food
— Automotive
— Chemical
— Pharmacy
— Services and distribution
— Other

Reserve companies were introduced when any of the selected companies declined to participate in the study. Fourteen reserve companies were ultimately included, of which only one declined to participate, requiring the inclusion of another reserve company. Table 5 presents the reasons given by the 15 companies or large business groups that declined to participate in the study.

Table 5. **Reasons given by the large companies that declined to participate**

Subsidiary of a multinational company that does not do a significant amount of R&D and prefers not to participate	2
Company declared it was not interested in participating	13
Total	15

It is worth highlighting two aspects with regard to the 13 companies that declared they were not interested in participating. Firstly, in terms of sector representation, we should state that a negative response was received from the three companies selected from the sector CNAE 22, «Publishing, graphic arts and reproduction of recorded material» (CNAE codes are the Spanish National Classification of Economic Activities codes), and also from the 2 large companies selected from the sector CNAE 32, which belong to consumer electronics. These are two sector groups for which it would have been desirable to have two companies per group, but which were unfortunately left without representation in the study.

The second aspect is related to group ownership. Five of the companies that declined to participate were family-run business groups, which normally state reasons of company policy with regard to providing the type of information being requested, despite the offer to sign a confidentiality contract.

2.2. FIELDWORK PROCEDURE

2.2.1. Contacting companies and their response

The following procedure was employed to contact the selected companies:

— CIDEM sends a letter to request participation (Appendix 5.3.1)
— Telephone follow-up to obtain a response:
  • Confirm receipt of letter (or resend via e-mail if not received).
  • Identify contact person at the company, obtain a response and, if affirmative, send the information request form to be filled in.
  • Determine a possible date for the interview (telephone or face-to-face).

For the telephone follow-up, the researchers in the study's work team, whether from the University of Barcelona or from the University of Girona, were grouped according to sectors.

It was often found that the person the introductory letter was addressed to was not the right person to contact and the researchers were sometimes redirected to other managers or departments. The lack of initial information regarding who to contact in the company appreciably slowed down this procedure of contacting and arranging a date for interview.

From the sample of companies, 50% were interviewed by telephone and the rest face-to-face. The interview always followed the same structure, regardless of whether it was conducted by telephone or face-to-face, although in the case of the telephone call it was found to be more artificial. Appendix 5.3.3. contains the guide to the interview procedure.

It was not always possible to conduct the interview with the information form available. In some cases, the manager of the company preferred to send it a few days after the interview. The follow-up telephone process for obtaining all of the information forms was in some cases very lengthy (up to three months).

2.2.2. Characteristics of the information requested on the form

The form was structured according to the model used for the R&D Scoreboard produced by the UK's Department of Trade and Industry and the EU's industrial R&D Investment Scoreboard.

The form is divided into five sections (Appendix 5.3.2). Data was requested from the period 2003 to 2005 regarding:

— R&D investment in Catalonia
— External financing of R&D
— Staff dedicated to R&D in Catalonia
— Participation in European R&D programmes (Framework or Eureka programme)

— Processes for outsourcing R&D activities (other companies, R&D centres, universities, etc.)
— Other data (company investments, sales figures and operating profit or loss).

2.2.3. La Conca Central del Llobregat and analysis of this area

The public call for proposals to conduct the study specified the requirement of conducting a specific territorial analysis, applying the same methodology, in order to observe its viability in more local areas. The area to be analysed was La Conca Central del Llobregat.

For the purposes of this analysis the area La Conca Central del Llobregat was considered to comprise the following administrative districts:

— El Baix Llobregat, from the municipality of Martorell (that is, companies were considered that were located in this municipality or neighbouring municipalities, or further north)
— The municipalities of Rubí and Terrassa in the administrative district of Vallès Occidental and the area of influence between these municipalities and the Llobregat River
— El Bages
— El Berguedà

Appendix 5.4 contains a map of the area considered for the purposes of this analysis.

Many of the large companies included in this study have more than one production plant in Catalonia.

The following approach was employed with regard to this point: the fieldwork was conducted with the selected companies and those companies that had an establishment located in the area of reference were recorded. A total of 13 companies were found to be in this situation.

A company was considered to form part of La Conca Central del Llobregat if it had a production plant in this area. It must be taken into account, however, that methodologically when companies have different production plants, it is not possible to divide the R&D of the company among its different establishments. It is for this reason that Section 3.2.6., which presents the results for La Conca Central del Llobregat, includes more detailed comments with regard to this analysis.

3

THE R&D CONDUCTED BY THE 50 LARGEST COMPANIES IN CATALONIA

3.1. CLASSIFICATIONS USED. SCOPE AND LIMITATIONS

3.1.1. The three classifications used for analysing results

The process selection detailed in the previous section led us to work with a total of 50 companies which for the purposes of this analysis were grouped according to three classifications:

— Sector groups
— Technological intensity
— Companies that are subsidiaries of multinationals and those which are not

Appendix 5.1 lists the CNAE codes included in the classifications by sector group and technological intensity, respectively. It also lists the OECD's classification of sectors according to technological intensity, which is the one that was ultimately used for this study. Table 6 includes the 50 analysed companies classified according to the three aforementioned categories. It should be taken into account that three groups are relatively heterogeneous: automotive, services and other.

Table 6. The 50 large companies and the classifications used in the study

Sector groups	Number of companies	Technological Intensity	Number of companies	Subsidiaries multinationals	Number of companies
Pharmacy	8	High technological intensity	9	Subsidiaries of multinationals	25
Automotive	8				
Food	8	High-medium technological intensity	18	Not subsidiaries of multinationals	25
Chemical	8				
Services and distribution	10	Medium-low/low technological intensity	23	**Total**	**50**
Other	8				
Total	**50**	**Total**	**50**		

Source: Own data.

Section 3.2 presents R&D indicators for the 50 large companies according to the above classifications. These indicators must be read bearing in mind the limitations of the sample and the classifications, that is, they cannot be considered to be strictly representative of that which happened in Catalonia during this period. Despite this, the results do allow us to identify evidence of an order of scale and in particular view company profiles with regard to the R&D behaviour of companies within a specific group and within each one of the different classifications.

3.1.2. Classification boundaries and considerations regarding the responses received

On the sector groupings. It must be taken into account that in half of the cases the groups are not very homogenous. Thus, automotive includes vehicle manufacturers, but also component manufacturers, regardless of the CNAE sector to which the company should be assigned according to the characteristics of the components. For their part, «services» include very important companies in terms of volume, but a very diverse window of activities (which shall be discussed in the section on sector analysis) and, finally, the group «other» incorporates companies from seven different sectors: three of these manufacture electrical material and three belong to activities considered of low technological intensity, according to OECD criteria.

Large business groups and CNAE coding. Another of the themes that emerges in an analysis of this type is the fact that in some cases the business group provides information regarding R&D activities which actually correspond to two different activities. Sometimes this was resolved by the fact that information was received on different forms;[16] in other instances, however, the information was used for the sector where the company had most of its business activity according to the face-to-face or telephone interviews conducted. This was the case, for example, with some pharmaceutical companies that have activities that fit into the «chemical» sector.

On the OECD classification of technological intensity. In the case of some large business groups, classification by «technological intensity» is very relative. This is the case for some companies that can be labelled as having «low technological intensity» according to their business sector, such as «service» companies or those with business activities normally considered to have little R&D, but which, given that they are conducting a considerable number of R&D activities related to information and communication technologies (ICTs) obtain, for example, very high R&D / sales ratios and other indicators, and where the «technological level» of these ICT activities is more in line with medium-high technological intensity than medium-low or low technological intensity.

16. This is the case with Alstom Power and Alstom Transports. Given their characteristics, these two companies have ultimately been considered to all intents and purposes two separate companies.

Available files. In the large majority of cases it has been possible to have available all data relating to investment and personnel allocated to R&D for the three years for which data was requested: 2003, 2004 and 2005.[17] Three companies, all subsidiaries of multinationals, agreed to participate in the study whilst making it clear that they did not conduct R&D activities in Catalonia. Their only expenses in this area were on innovation, which they either did not have available as quantified data or did not wish to provide. The qualitative assessments of these three companies have been incorporated into the corresponding sections.

3.2. RESULTS TABLES AND FIGURES

3.2.1. Investment and personnel allocated to R&D

In 2005 the 50 companies analysed invested a total of 631.32 million euros in R&D and employed 4,595 people in R&D-related work (Table 7). 81.7% of this investment was made by just two sector groups: pharmacy and automotive (Figure 3). In the case of the automotive group, the weight of several large companies is a determining factor in the size of this investment in R&D with regard to the 50 companies as a whole; thus, in the automotive sector the volume of resources of manufacturing companies is very high in comparison with supply companies. The characteristics of this group are commented on in Section 3.3.3.

Mention should also be made of the significant volume of people working in R&D in the service sector: 685. This may seem a surprising amount for the sector, and requires a brief explanation. Many activities relating to innovation in this sector—in the companies analysed—are related to the development of software associated with commercial logistics, monitoring and control processes. For these companies these are strategic activities in which a large number of human resources are employed, even though the average financial investment only reaches 7 million euros.

If we observe how total investment in R&D by the 50 companies evolves during the period object of this study, there was a 3.8% growth in R&D investment between 2003 and 2004 and 2.8% growth between 2004 and 2005 (Table 8). These data reflecting global growth must be read with some caution, however, due to the changes in the scope of the sector groups (Figure 1). These percentages vary if we take into account all of the companies except those belonging to the automotive sector. For this latter group, growth in R&D investment is 23.5% between 2003 and 2004 and 17.7% between 2004 and 2005.

Mention should also be made of the growth in the pharmacy, services and distribution and food sectors, reflected in Figure 1. In the former, there is growth approaching 50% when comparing 2003 data to that of 2005. The services and distribution sector doubles its

17. 43 companies provided basic data for 2003, 2004 and 2005 and 3 companies stated that they did not conduct any R&D.

investment in the same period, although starting from a lower figure in comparison with the leading sectors. Finally, the food sector also shows growth at a rate of 60% for the period of reference, although the volume of investment is small.

Table 7. **Investment in R&D and personnel allocated to R&D in 2005**

	Investment in R&D (millions of €)		R&D personnel to sales (%)		R&D compared
	Average investment in R&D	Investment in R&D in the sector group	Average no. of personnel allocated to R&D	Total personnel allocated to R&D	Investment in R&D/ sales (average for sector group)
Pharmacy	29.91	239.29	164	1,312	8.23%
Automotive	33.97*	271.83	264.63*	2,117	1.31%
Food	1.86	14.91	9.13	73	0.30%
Chemical	1.90	15.16	23.63	189	0.59%
Services and distribution	7.00	69.95	68.50	685	0.53%
Other	2.52	20.18	27.38	219	0.88%
Total		**631.32**		**4,595**	

Source: Own data according to data provided by the 50 companies participating in the study.[18]
* Average investment and average number of personnel cannot be considered representative in this case due to the weight of the large automobile manufacturers.

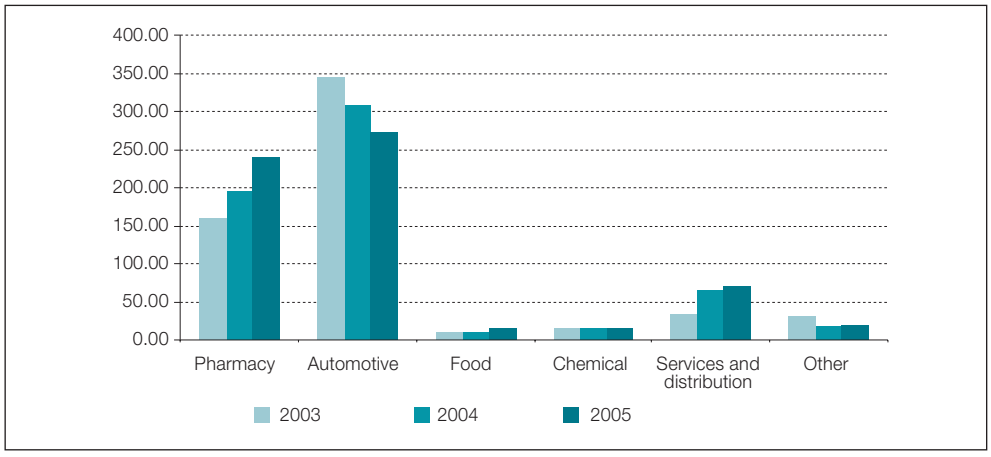
Table 8. **Evolution in R&D investment by sector group (2003-2005)**

	2003		2004		2005	
	Investment in R&D	Weight of sector compared to total investment	Investment in R&D	Weight of sector compared to total investment	Investment in R&D	Weight of sector compared to total investment
Pharmacy	159.08	26.88%	195.31	31.79%	239.29	37.90%
Automotive	344.72	58.24%	308.98	50.30%	271.83	43.06%
Food	9.22	1.56%	10.37	1.69%	14.91	2.36%
Chemical	14.31	2.42%	15.32	2.49%	15.16	2.40%
Services and distribution	33.02	5.58%	65.47	10.66%	69.95	11.08%
Other	31.52	5.33%	18.84	3.07%	20.18	3.20%
Total	**591.88**	**100%**	**614.29**	**100%**	**631.32**	**100%**

Source: Own data. Figures in millions of euros.

18. From this section onwards, in tables and graphs where the source is given as own data, it is to be understood that the data was taken from information provided by the 50 companies participating in the study through surveys and interviews.

Figure 1. **Evolution in R&D investment by sector group (2003-2005)**



Source: Own data. Figures in millions of euros.

As was highlighted at the beginning of this section, the number of people allocated to R&D activities in Catalan companies grew from 4,000 to almost 4,600, representing a growth of 15.2% in three years (see Table 9). The most significant growth was among companies we have grouped in the services and distribution sector. However, it is also worth highlighting the increased number of employees in the pharmacy sector, which already had 1,000 employees and added a further 300, and the food sector. Figure 2 provides this data in a different format.

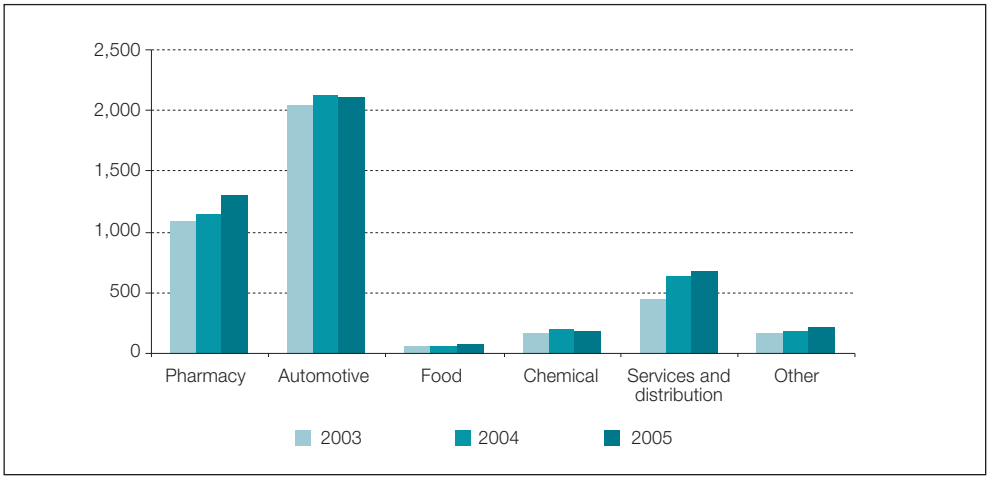
Table 9. **Evolution in number of personnel allocated to R&D by sector group (2003-2005)**

	2003		2004		2005	
	Personnel in R&D	Weight of sector compared to total investment	Personnel in R&D	Weight of sector compared to total investment	Personnel in R&D	Weight of sector compared to total investment
Pharmacy	1,094	27.43%	1,155	26.41%	1,312	28.55%
Automotive	2,053	51.47%	2,132	48.75%	2,117	46.07%
Food	58	1.45%	67	1.53%	73	1.59%
Chemical	167	4.19%	194	4.44%	189	4.11%
Services and distribution	445	11.15%	637	14.57%	685	14.90%
Other	172	4.31%	188	4.29%	219	4.77%
Total	**3,989**	**100%**	**4,373**	**100%**	**4,595**	**100%**

Source: Own data.

Table 10 has been constructed in order to demonstrate the growth in R&D investment by the 50 leading Catalan companies. It includes the number of companies within each sector group with growth of over 5%. The Catalan GDP grew at a rate of 3% during the period 2000-2005 and at a rate of 3.1% in Spain. Table 11 displays the percentage growth of investment in R&D by sector for 2005, with growth approaching 40% for the pharmacy and automotive sectors standing out.

Figure 2. **Evolution in number of personnel allocated to R&D by sector group (2003-2005)**



Source: Own data.

Table 10. **Number of companies with a growth in R&D investment above 5% between 2004 and 2005**

Pharmacy	Automotive	Food	Chemical	Services and dist.	Other
3	2	3	1	5	3

Source: Own data.

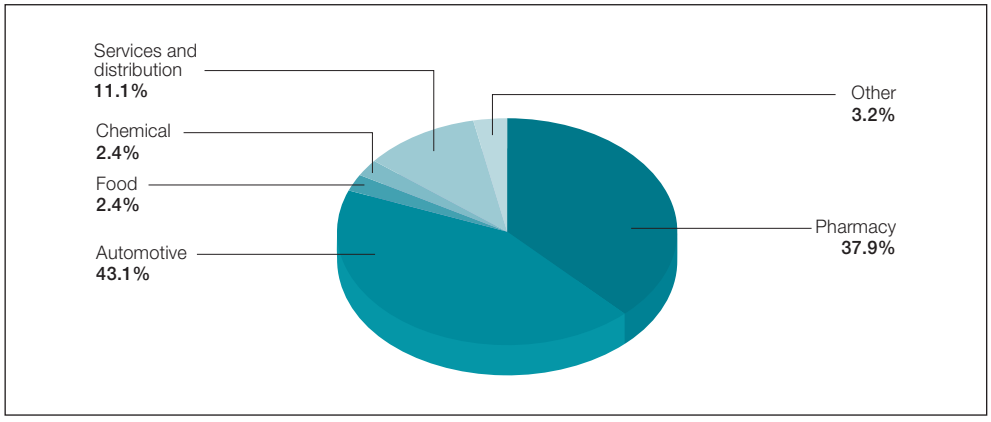
The most commonly-used indicator by companies when explaining the importance of R&D within their business activity is the ratio between investment in R&D and sales. Table 12 and Figure 4 present this indicator for all of the different sector groups in which the 50 companies are distributed. In terms of average global change, this figure was 2.22% for 2003, 2.45% for 2004 and 1.99% for 2005.

Table 11. **Distribution of R&D investment by the 50 companies according to sector group (2005)**

	Investment in R+D*	Weight of the sector compared to total investment
Pharmacy	239.29	37.9%
Automotive	271.83	43.1%
Food	14.91	2.4%
Chemical	15.16	2.4%
Services	69.95	11.1%
Other	20.18	3.2%
Total	**631.32**	**100.0%**

Source: Own data. * Figures in millions of euros.

Figure 3. **Distribution of R&D investment by the 50 companies according to sector group (2005)**



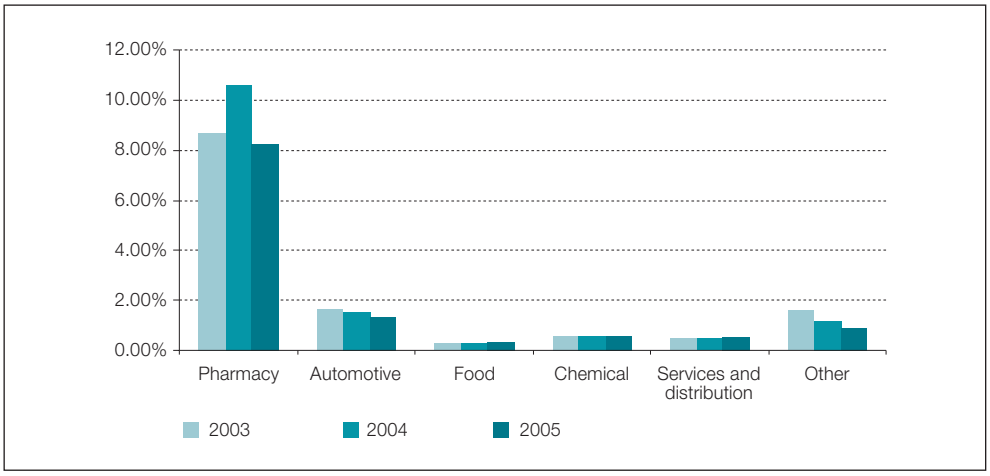
Source: Own data.

Table 12. **Evolution in R&D investment / Sales ratio. Sector groups (2003-2005)**

	2003	2004	2005
Pharmacy	8.69%	10.61%	8.23%
Automotive	1.65%	1.53%	1.31%
Food	0.24%	0.26%	0.30%
Chemical	0.58%	0.56%	0.59%
Services and distribution	0.46%	0.45%	0.53%
Other	1.60%	1.16%	0.88%

Source: Own data. Figures in millions of euros.

Figure 4. **Evolution in R&D investment / Sales ratio. Sector groups (2003-2005)**



Source: Own data.

Naturally, figures for companies from the pharmaceutical sector stand out as they belong to a «high technological intensity» sector (according to OECD criteria), where high levels of competitiveness lead to a very high volume of resources being allocated to R&D activities, somewhere between 8% and 10%, well above the global average. At the other extreme we find the food sector, where there is very little technological intensity and where there was a rate of just 0.27% for this indicator for the period 2003-2005.

We provide data in graphic form throughout this report, and in this case Figure 4 presents a bar graph that demonstrates the differences in the ratio of R&D investment to sales. The significant difference with the pharmaceutical sector must not divert our attention from the interesting comparison of the values for the automotive and chemical companies, which maintain a sustained rate throughout the whole period of 1.6% and 0.58%, respectively.

3.2.2. Classification of companies by technological intensity

If we classify the 50 companies according to the technological intensity of the sector in which they are grouped, we find evidence of an important weight of business activities relating to high and medium-high technological intensities (Table 13 and Figure 5).[19]

It is the weight of the pharmaceutical companies in the group with high technological intensity that makes this situation of high growth in investment possible (22.3% between 2004 and 2005).

19. Table 47 in Appendix 5.1 provides details of the OECD classification of technological intensities used in this section.

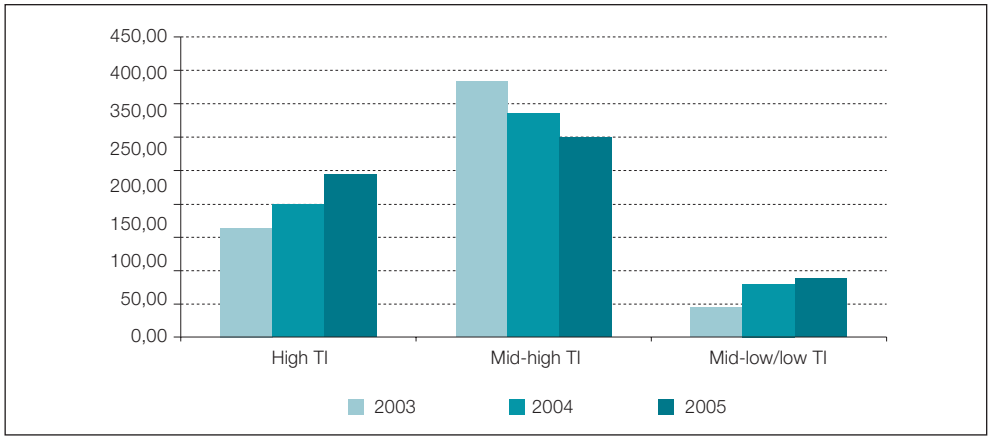
Equally, the weight of the automotive companies is at the root of the negative evolution of the medium-high technological intensity group. For their part, the group of companies with medium-low/low technological intensity shows good progress; in the period 2004-2005 there was a 10.5% growth in R&D investment. Figure 5 clearly demonstrates this fact. Figure 6 presents the percentages for the R&D investment figures of the three groups by technological intensity for 2005, represented in the third column of Table 13. Almost half of R&D investment by the 50 companies belongs to the group with high technological intensity.

Table 13. **Evolution in R&D investment by companies according to groups of technological intensity (2003-2005)**

Technological intensity of companies	2003	2004	2005
High	163.08	199.11	243.59
Mid / high	383.32	335.74	299.90
Mid-low / low	45.49	79.44	87.82
Total	**591.88**	**614.29**	**631.32**

Source: Own data. *Figures in millions of euros.

Figure 5. **Evolution in R&D investment by companies according to groups of technological intensity (2003-2005)**

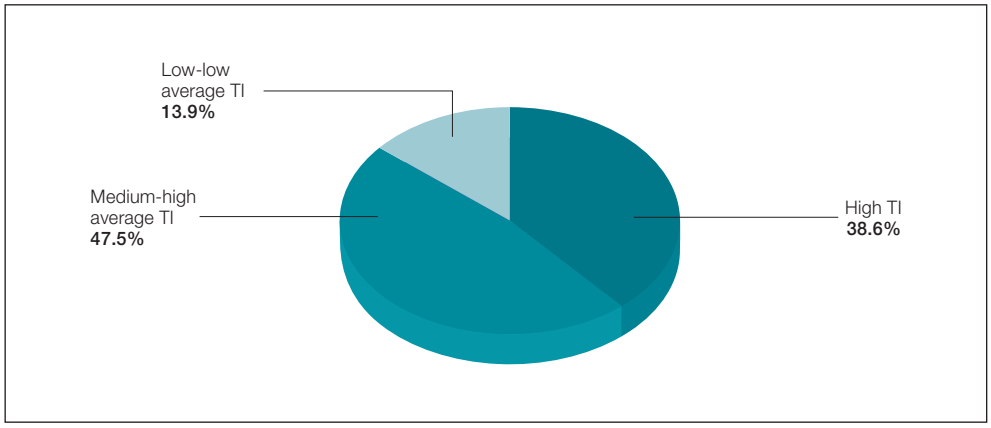


Source: Own data. Figures in millions of euros.

Graphs 7 and 8 display the relationship between sales and growth in R&D investment for the period 2003-2005. This is the type of graph often used in scoreboard analysis. The graph was constructed for the groups with high and medium-high technological intensity and the vari-

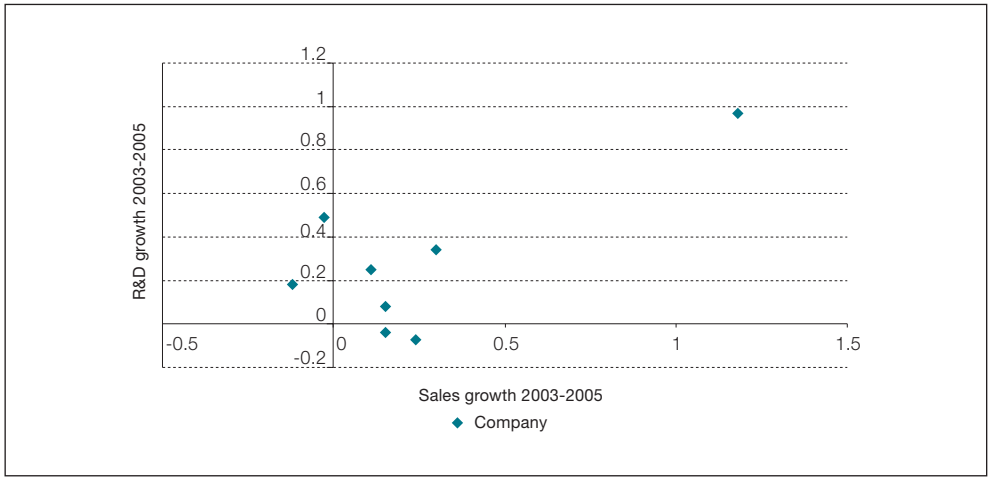
ables used employ «growth» values in order to guarantee the anonymity of the companies. Companies have been included in these graphs where information was available for the two variables. In the group with high technological intensity, the dots correspond to 8 companies, in the group with medium-high technological intensity there are 13 from a total of 18.

Figure 6. Distribution of R&D investment by the 50 companies according to groups of technological intensity (2005)



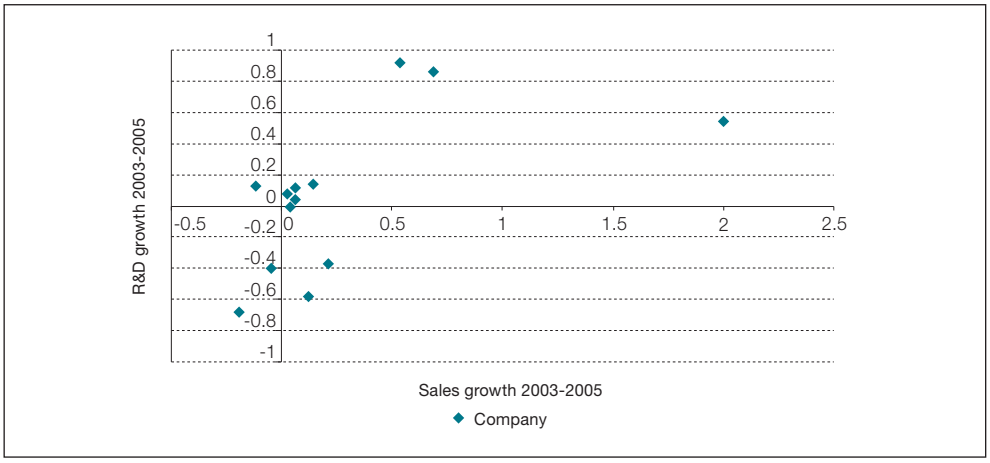
Source: Own data.

Figure 7. Relationship between growth in sales and growth in R&D investment (2003-2005). Companies with high technological intensity



Source: Own data.

Figure 8. Relationship between growth in sales and growth in R&D investment (2003-2005). Companies with medium-high technological intensity



Source: Own data.

For companies with high technological intensity, a sample of only eight companies means that results will not be completely clear with regard to the relationship existing between growth in R&D and growth in sales for this period. There are companies with the same sales growth but different growths for R&D investment. There is one case where when sales growth exceeds 1 growth in R&D investment also exceeds 1. Despite this, however, there is not sufficient data to conclude that higher sales growths correspond to higher R&D investment.

If we observe the companies with medium-high technological intensity, the sample is of 13 companies. In this case, we find that for moderate levels of sales growth in this period the growth in R&D investment is also moderate. In parallel with this, it can be observed that for companies with high growth rates in sales there may be an inverse relationship between growth in sales and growth in R&D investment. That is, a higher growth in sales does not always translate into a higher growth in R&D investment.

3.2.3. Classification of companies into subsidiaries and non-subsidiaries

With regard to this question, it should be reiterated here that, as we are dealing with 50 companies, and given the size of some of the automobile companies involved, the results in this section separating subsidiaries from non-subsidiaries must be considered with caution. The weight of manufacturers in the automotive sector gives a result in which the total invest-

ment of subsidiaries exceeds that of non-subsidiaries and means that the number of personnel allocated to R&D is similar when the two data are compared. If we do not count these automobile companies, the results for investment and personnel in R&D in subsidiary companies would be much lower than those for non-subsidiaries.

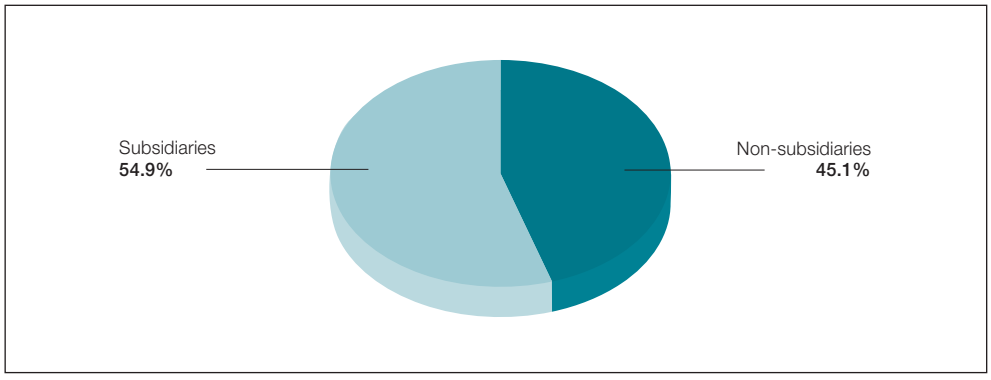
Half of the 50 companies are subsidiaries of multinationals. Their behaviour in terms of R&D is different due to the fact that certain R&D investment decisions must be coordinated with head office (Table 14).

Table 14. R&D investment in 2005. Subsidiaries and non-subsidiaries

Companies	Investment in R+D*	%
Non-subsidiaries	284.60	45.1%
Subsidiaries	346.80	54.9%
Total	**631.40**	**100.0%**

Source: Own data. *Figures in millions of euros.

Figure 9. R&D investment in 2005. Subsidiaries and non-subsidiaries



Source: Own data.

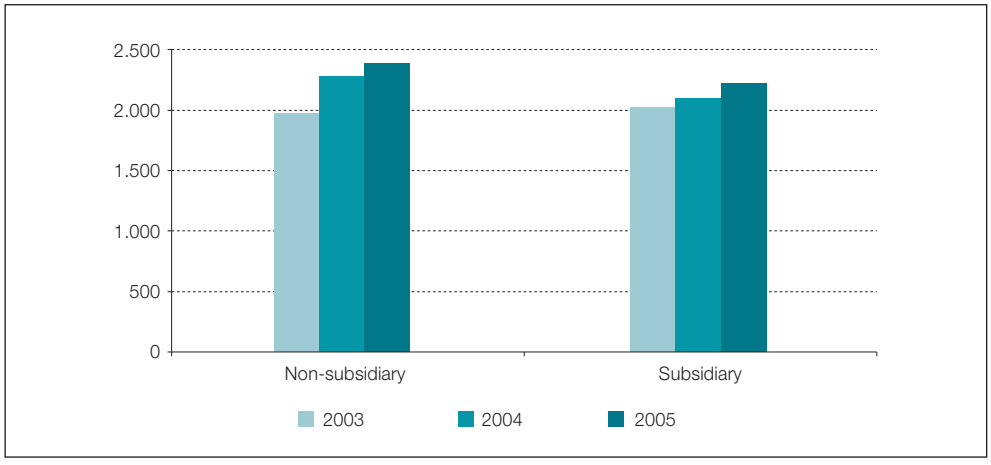
There is a positive evolution of personnel allocated to R&D in the 50 companies (Table 15 and Figure 10), as can be observed in the tables in the two previous sections. Despite this, however, the behaviour of the relationship between R&D and sales is irregular (Table 17 and Figure 11), and it is therefore impossible to draw any clear conclusions from this first look at the data. Table 16 again provides evidence of the balance between subsidiaries and non-subsidiaries: eight non-subsidiaries and nine subsidiaries increased their investment by over 5% between 2004 and 2005.

Table 15. Evolution in personnel allocated to R&D (2003-2005)

Companies	2003	2004	2005
Non-subsidiaries	1,966	2,275	2,378
Subsidiaries	2,023	2,098	2,217
Total	**3,989**	**4,373**	**4,595**

Source: Own data.

Figure 10. Evolution in personnel allocated to R&D (2003-2005). Subsidiaries and non-subsidiaries



Source: Own data.

Table 16. Number of subsidiaries and non-subsidiaries with growth in R&D investment of over 5% between 2004 and 2005

Subsidiaries	Non-subsidiaries	Total
8	**9**	**17**

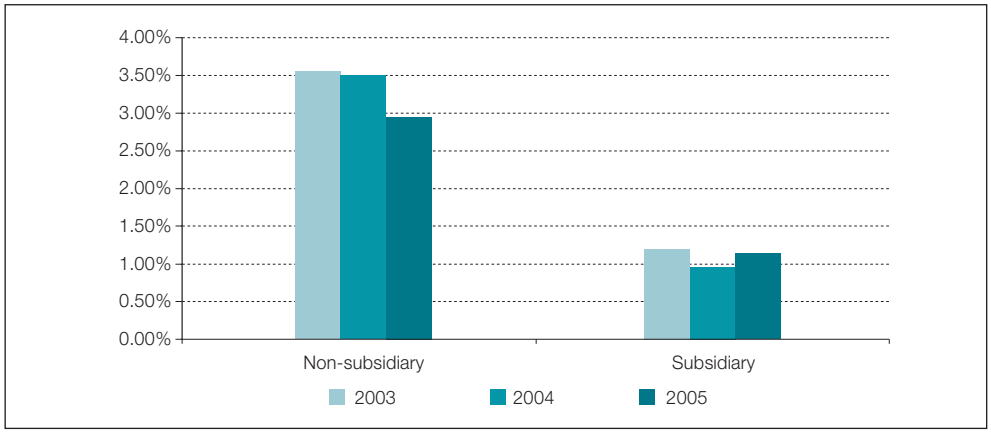
Source: Own data.

Table 17. R&D investment / sales evolution. Subsidiaries and non-subsidiaries (2003-2005)

Companies	2003	2004	2005
Non-subsidiaries	3.56%	3.50%	2.95%
Subsidiaries	1.19%	0.96%	1.14%

Source: Own data.

Figure 11. **R&D investment / sales evolution. Subsidiaries and non-subsidiaries (2003-2005)**



Source: Own data.

3.2.4. External financing

Among other data requested from companies was that relating to the external financing of R&D, referring in particular to subsidies or loans from public R&D&i support programmes and, if applicable, financing received from other companies for whom they had carried out some type of project. We must remember here that according to EU Industrial Scoreboard methodology financing is recorded separately from R&D investment. Table 18 presents the

Table 18. **R&D investment and external R&D financing. 2005**

	R&D investment		External financing	
	Average investment R&D	Investment in R&D for sector group	Average financing	Financing received by all companies in the sector group
Pharmacy	29.91	239.29	2.20	13.20
Automotive	33.97*	271.83	0.75	4.50
Food	1.86	14.91	0.13	1.52
Chemical	1.90	15.16	0.53	2.63
Services and distribution	7.00	69.95	0.54	2.70
Other	2.52	20.18	1.45	8.72
Total		**631.32**		**33.27**

Source: Own data. Figures in millions of euros.
* Average investment cannot be considered to be completely representative due to the weight of the large automobile manufacturers.

data available for 2005 as well as data for R&D investment. Of the 50 companies, 19 did not provide data for this concept. In most of these cases, according to comments made during the interviews, we can consider the amount to have been zero or «practically zero».

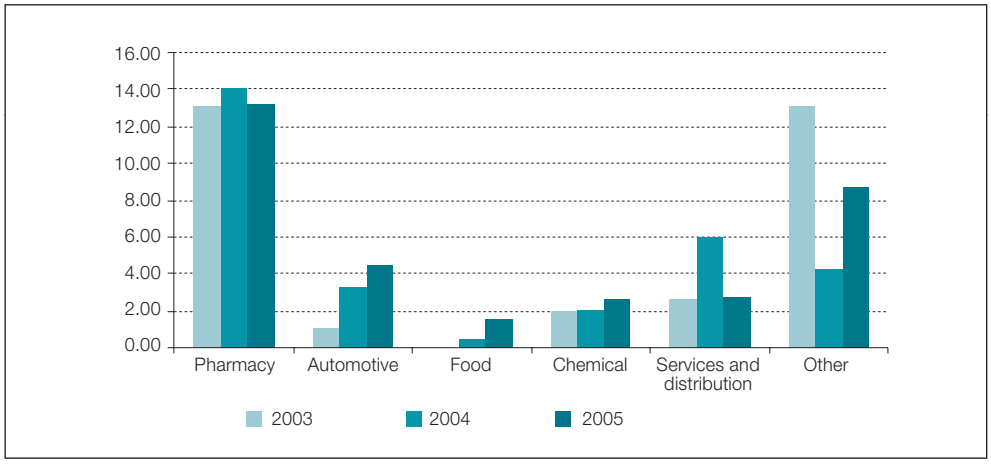
Table 19 and Figure 12 list and represent the evolution of these data from 2003 to 2005 from a sector perspective. Table 8 demonstrates that there are two groups of companies in which external financing has a more significant weight when comparing figures for financing and investment: the chemical sector and the group «other». This result may cause some confusion due to the fact that some important companies in the pharmacy and automotive sectors did not provide details of financing received from the Profit programme, which was of particular significance precisely during the period 2003-2005. By contrast, the volume of

Table 19. **Evolution in external financing by sector group (2003-2005)**

	2003	2004	2005
Pharmacy	13.10	14.00	13.20
Automotive	1.10	3.32	4.50
Food	0.01	0.46	1.52
Chemical	1.95	2.04	2.63
Services and distribution	2.65	6.03	2.70
Other	13.05	4.22	8.72
Total	**31.87**	**30.06**	**33.27**

Source: Own data. Figures in millions of euros.

Figure 12. **Evolution in external financing by sector group (2003-2005)**



Source: Own data. Figures in millions of euros.

financing in the «other» group was high because in this case the companies that received financing from the Profit programme did include this in the information they submitted. The case of the «other» group must be understood as different from the others for this reason, that two companies with very high levels of financing from the Profit programmes coincide in this group. There is very little external financing in the food sector, whilst the service and distribution sector displays irregular behaviour.

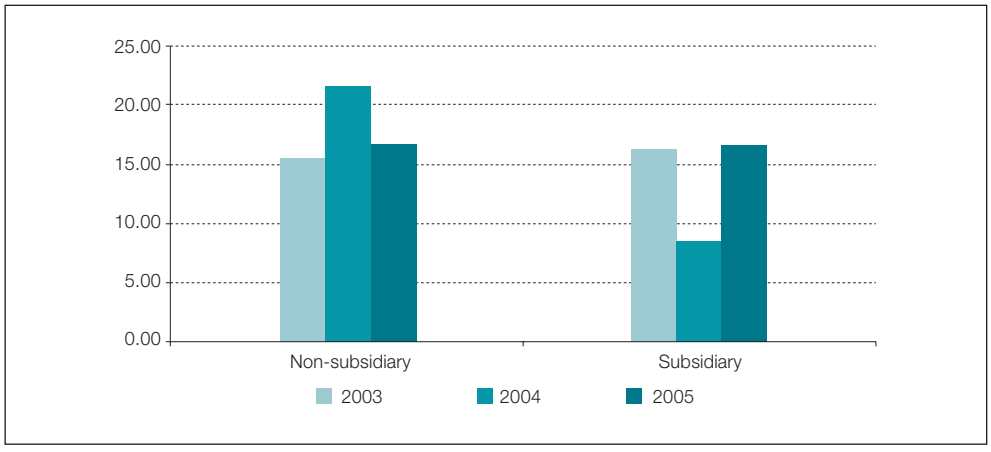
Table 20 and Figure 13 present the evolution in financing, separating subsidiaries from non-subsidiaries. The results are irregular and no significant trends are identified in any respect.

Table 20. **Evolution in total external financing. Subsidiaries and non-subsidiaries**

Companies	2003	2004	2005
Non-subsidiaries	15.56	21.61	16.68
Subsidiaries	16.30	8.46	16.59
Total	**31.87**	**30.06**	**33.27**

Source: Own data. Figures in millions of euros.

Figure 13. **Evolution in total external financing. Subsidiaries and non-subsidiaries**



Source: Own data. Figures in millions of euros.

3.2.5. The 50 companies and the EU R&D Investment Scoreboards for 2005

Table 21 lists the companies that, by level of R&D investment, are at a level comparable to that of the companies which form part of the top 1000 on the EU Scoreboard for 2005: 23 of

the 50 companies would make this top 1000, which for 2005 has an R&D investment threshold of 2.67 million euros.

Table 21. **The 50 companies and the European R&D Investment Scoreboard for 2005**

Number of companies of the largest 50 companies in Catalonia which due to their level of R&D investment in 2005	
Would make the European Scoreboard top 100	1
Would make the European Scoreboard top 200	3
Would make the European Scoreboard top 500	11
Would make the European Scoreboard top 1000	23

Source: Own data. Figures in millions of euros.

Of the subsidiaries included in our study, a total of 12 of their mother companies have been identified as forming part of the top 100[20] on the European Scoreboard. Furthermore, 10 of these multinationals have a subsidiary in Catalonia which would make the top 1000 themselves with regard to R&D investment, and not taking into account the mother company. With regard to the sample selected here, it should be viewed positively that 10 of the 25 subsidiaries comprising part of the 50 companies analysed have levels of investment in the top European 1000, with their mother company in the top 100.

Table 22 presents the companies that would make the top 1000 European broken down according to the three principal classifications of the study, including all of the companies in the pharmacy sector. In this sector, a quintessentially high-technology sector, of the eight companies that form part of the 50 analysed in this study, five would also make the top 500. With regard to the automotive and service and distribution sector groups, half of the companies from each group would also form part of the aforementioned top 1000. Although the Scoreboard is supposedly of a more «industrial» nature, it also includes increasing numbers of service companies, in particular financial institutions. It is worthy of note that five company groups from the «services and distribution» sector have levels of R&D investment that would place them among the top 1000. Section 3.3.6 provides greater details with regard to the characteristics of the R&D activities of this sector group.

Once again, the distribution between groups is very balanced, whether looking at the number of companies by technological intensity or considering distribution between subsidiaries and non-subsidiaries. In any event, it is worth noting that if we do not count the manufacturing companies in the automotive sector, 10 of the 13 subsidiaries are found out-

20. As highlighted in Section 2, the R&D Investment Scoreboards only include available data. Companies that do not make their R&D data public are not listed. In fact, the other ten companies in this study that do not make the European Top 100 either belong to sectors of lower technological intensity such as food, or are companies which, from our point of view, are not included on the scoreboards because they did not provide data.

side the top 500, whilst in the case of non-subsidiaries the proportion is inverse and eight of the 11 companies that would make the top 500 are non-subsidiaries.

Finally, Table 23 displays the distribution of the five companies of the top 50 that would make the top 1000 on the Global Scoreboard of «non-European» companies. Two of these would make the top 500.[21]

Table 22. **The 23 companies that due to their level of R&D investment in 2005 would make the top 1000 on the European R&D Investment Scoreboards for 2005**

Sector groups	Number of companies	Technological intensity	Number of companies	Subsidiaries of multinationals	Number of companies
Pharmacy	8	High tech. intensity	9	Subsidiaries of multinationals	10
Automotive	4				
Food	2	Medium technological intensity	7	Non-subsidiaries of multinationals	13
Chemical	2				
Services	5	Low technological intensity	7	**Total**	**23**
Other	2				
Total	**23**	**Total**	**23**		

Source: Own data.

Table 23. **The 5 companies that due to their level of R&D investment in 2005 would make the top 1000 on the non-European R&D Investment Scoreboards for 2005**

Sector groups	Number of companies	Technological intensity	Number of companies	Subsidiaries of multinationals	Number of companies
Pharmacy	3	High tech. intensity	3	Subsidiaries of multinationals	3
Automotive	2	Medium technological intensity	2	Non-subsidiaries of multinationals	
Total	**5**	Low technological intensity	0	**Total**	**5**
		Total	**5**		

Source: Own data.

21. The cut-off levels of investment in R&D are 24.91 and 71.42 million euros, respectively.

3.2.6. R&D by large companies in La Conca Central del Llobregat

According to the geographical boundaries established in section 2.2.3, there are 13 companies of the 50 that have some type of presence in La Conca Central del Llobregat. In nine of these cases, the company is not solely present in this geographical area. That is, the companies or business groups have one of their production plants in the geographical area referred to, but they also have others in other parts of Catalonia. Furthermore, one of the three companies that professed not to conduct any R&D activity was located in this area.

The dominant axis in this location is formed by three neighbouring municipalities, Abrera, Martorell and Castellbisbal: eight of the 13 companies have a plant in this area. The other three cases are the location of three companies in the Vallès area of influence (Rubí, Terrassa), one in Manresa and another in Berguedà.

Table 24 presents the distribution of the 13 companies by sector. Due to the location there is, of course, a significant weight of companies from the automotive and chemical sectors, two sectors which, due to their characteristics, are considered mature. As far as the companies in the group «other» are concerned, these are two companies from the electrical machinery and materials sector. In the case of the chemical companies, four of the five companies have one of their production plants in La Conca Central del Llobregat and on the Abrera, Martorell, Castellbisbal axis. With regard to the presence of multinational groups, 9 of the 13 companies are subsidiaries of multinationals.

Table 24. Distribution by sector. Companies in the study present in La Conca Central del Llobregat

Sector	Companies
Automotive	5
Chemical	5
Services and distribution	1
Other	2

Source: Own data.

Table 25 details the investment and personnel allocated to R&D in these companies. Data regarding the evolution of expenditure and personnel[22] obtain similar results to those of all of the 50 companies, with regard to both the decline of the automotive sector and a certain linearity in the evolution of the other three sectors.

Table 26 presents the principal amounts with regard to external financing. In most cases this is financing associated with Profit programmes and loans from the CDTI (Centre for the Development of Industrial Technology), whilst we find that there is little European funding. As we are dealing with a small number of companies, the data allow relatively individualised

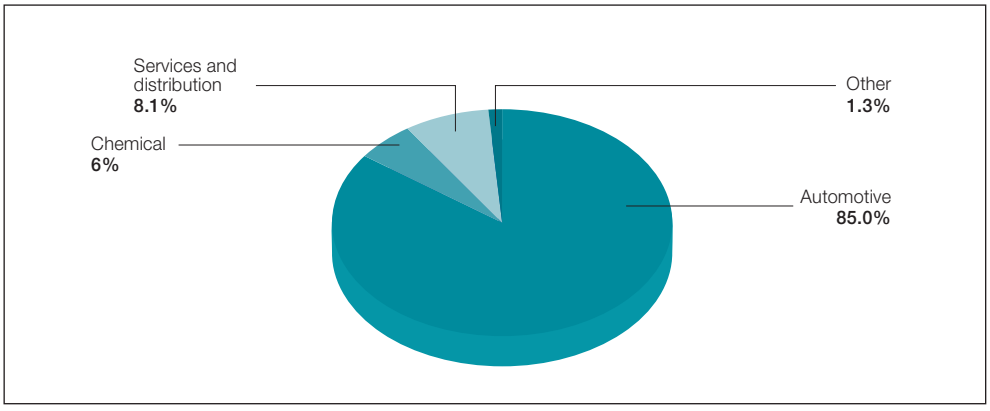
22. Not included, as due to their characteristics they do not preserve sufficient company anonymity.

Table 25. **Investment in personnel and R&D. Companies in the study present in La Conca Central del Llobregat**

Sector	R&D investment	%	R&D personnel
Automotive	171.13	85.0%	1.389
Chemical	11.25	5.6%	136
Services and distribution	16.32	8.1%	237
Other	2.67	1.3%	71
Total	**201.38**		**1.832**

Source: Own data. Investment in R&D en millions of euros.

Figure 14. **Distribution of R&D investment. Companies in the study present in La Conca Central del Llobregat**



Source: Own data.

Table 26. **External R&D financing. Companies in the study present in La Conca Central del Llobregat**

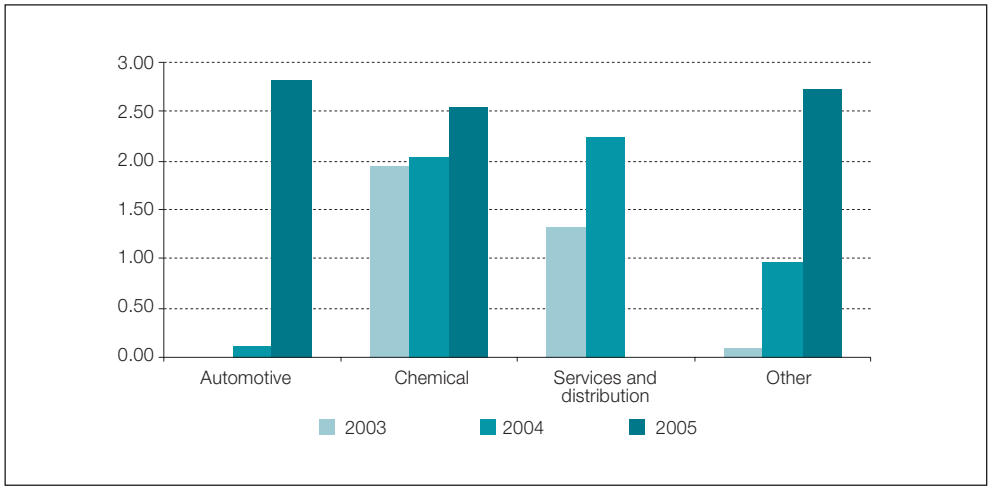
	2003	2004	2005
Automotive	0.00	0.12	2.82
Chemical	1.95	2.03	2.54
Services and distribution	1.32	2.24	–
Other	0.10	0.96	2.73
Total	3.37	5.35	8.09

Source: Own data. Figures in millions of euros.

comment. The chemical companies in the group demonstrate (as was the case with the overall results) a relatively stable behaviour with regard to receiving financing. The extreme figures for 2005 in the automotive sector and the group «other» correspond to specific years in which significant loans were received from the Profit programme.

Of the 13 companies, only two had a growth in R&D investment of over 5% for the period 2004-2005. None of the companies from the high technological intensity sector are present. Furthermore, given the majority presence of subsidiary companies the evolution of R&D compared to sales presented in Figure 17 is much more representative of this group, where there was a continual decrease during the period object of study.

Figure 15. **External financing of R&D. Companies in the study present in La Conca Central del Llobregat**



Source: Own data. Figures in millions of euros.

Table 27. **Technological intensity and R&D investment. Companies in the study present in La Conca Central del Llobregat**

	2003	2004	2005	% (2005)
Medium-high TI	299.19	240.90	185.05	91.89%
Medium-low/low TI	11.94	14.32	16.32	8.11%
Total	**311.13**	**255.22**	**201.38**	**100%**

Source: Own data. Figures in millions of euros.

As far as rankings are concerned, four companies would make (as a group, not exclusively due to their presence in La Conca Central del Llobregat) the top 1000 on the European Scoreboard, two of these four the top 500 and one the top 1000.

Lastly, Figure 18 details the growth in sales and R&D. The graph is fairly similar to Figure 8, which detailed the same relationship for all of the companies of medium-high technological intensity.

Table 28. R&D investment for 2005. Subsidiaries and non-subsidiaries. Companies in the study present in La Conca Central del Llobregat

Companies	2003	2004
Non-subsidiary	23.1	11.4%
Subsidiary	178.3	88.6%
Total	**201.38**	**100%**

Source: Own data. Figures in millions of euros.

Table 29. Evolution in R&D / Sales. Total for the «sector group». Companies in the study present in La Conca Central del Llobregat

	2003	2004	2005
Automotive	1.71%	1.40%	1.03%
Chemical	0.50%	0.51%	0.46%
Services and distribution	0.94%	1.00%	0.89%
Other	0.68%	0.95%	0.42%

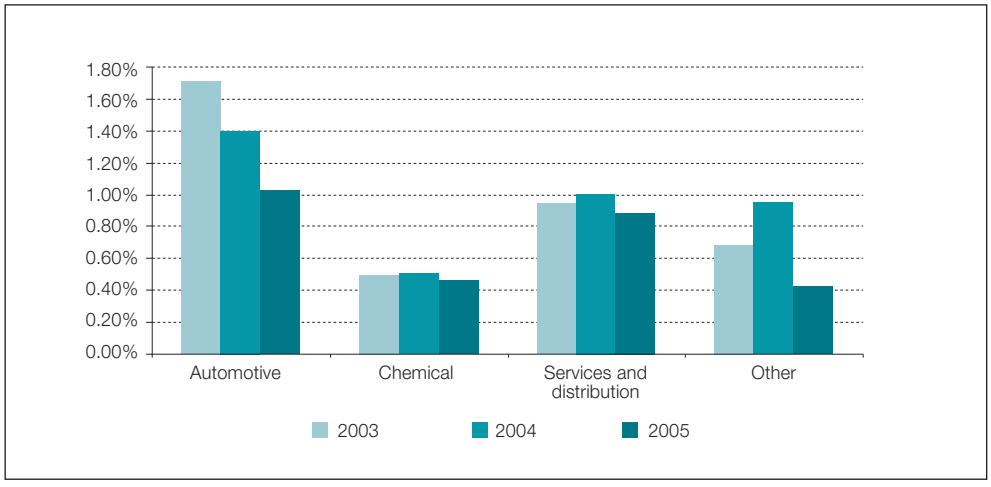
Source: Own data. Figures in millions of euros.

Table 30. Evolution in R&D / Sales. Subsidiaries and non-subsidiaries. Companies in the study present in La Conca Central del Llobregat

Company	2003	2004	2005
Non-subsidiary	0.80%	1.03%	0.55%
Subsidiary	1.18%	1.04%	0.83%

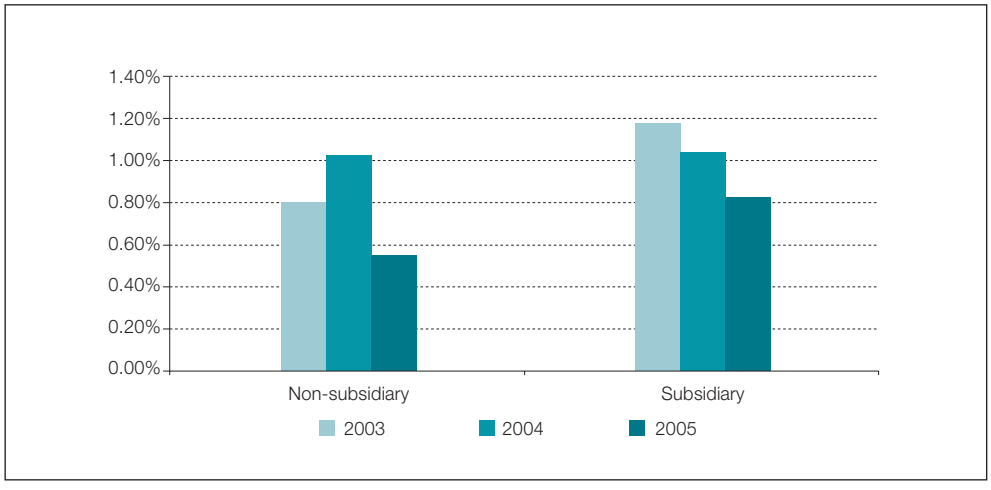
Source: Own data.

Figure 16. **Evolution in R&D / Sales. Total for the «sector group». Companies in the study present in La Conca Central del Llobregat**



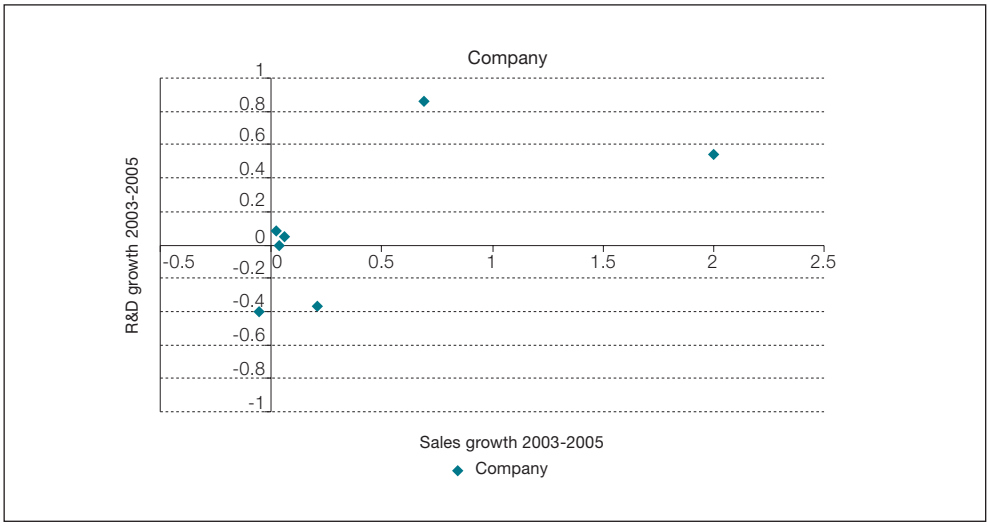
Source: Own data.

Figure 17. **Evolution in R&D / Sales. Subsidiaries and non-subsidiaries. Companies in the study present in La Conca Central del Llobregat**



Source: Own data.

Figure 18. Growth in R&D / Sales. Subsidiaries and non-subsidiaries. Companies in the study present in La Conca Central del Llobregat



Source: Own data.

For companies located in La Conca Central del Llobregat, a sample of only seven companies once again means that the results obtained are not entirely clear with regard to the correlation existing between R&D growth and sales growth. In this case, we observe that with moderate levels of sales growth there are also moderate levels of growth in R&D investment. In parallel with this, with regard to companies with high rates of sales growth, we detect that there may be an inverse relationship between growth in sales and growth in R&D investment. That is, a higher growth in sales does not always translate into a higher growth in R&D investment. We must however insist on the fact that a larger number of companies would be necessary in the sample in order to draw more meaningful conclusions.

3.3. SECTOR OVERVIEW

3.3.1. Introduction

In this section we present the results of the study according to the classification by sectors established in Section 3.1. There is a brief introduction to each sector in order to provide context for the data obtained from the surveys. We must however remember that the selected sample of companies cannot be considered to be fully statistically representative,

although it can give an indication of the main trends in R&D investment by the 50 largest companies in Catalonia. What this section therefore provides is an explanation of the view these large companies have with regard to their R&D as well as their possible view of the sector to which they belong. We therefore provide comment here on the most relevant data of this group of companies and the aspects and qualitative considerations of most interest to have arisen from the interviews conducted.

3.3.2. Food

Sector context

The food and drinks sector is a strategic sector within the EU, where it maintains a stable growth of 2%. In Spain, it represents 20% of all industrial production, whilst in Catalonia this percentage is 16% in terms of turnover and 11.5% in terms of added value for the whole of Catalan industry.[23]

Catalonia offers a significant level of know-how in food production and technology and is a leader in terms of ingredients suppliers and packaging and process technology companies. Taken as a whole, this means we are able to refer to an advanced cluster of food companies. The importance of the sector is reflected in the fact that over 3,500 companies in the Spanish food industry are based in Catalonia. These companies represent 23% of all production in the Spanish food sector and employ a fifth of all workers in the Spanish food industry.

The corporate world of the Catalan food sector is extremely diverse, comprising from native companies which have become authentic multinationals to small and extremely dynamic companies and foreign multinationals.

If we analyse the British Department of Trade and Industry's R&D Scoreboards for 2006 with regard to R&D investment,[24] the food sector occupies 15th place in the ranking of the 15 sectors with highest R&D investment. This sector is considered to have low intensity in terms of R&D, with ratios of investment in R&D / sales situated somewhere between 1.4% and to 2.4%.

Group of food sector companies analysed

The group of companies from the food sector included in this study comprises five multinational companies (Nestlé, Cobega, Unilever, Bimbo and Pepsico) and three Catalan companies (Panrico, Damm and Corporació Alimentària de Guissona). Nestlé-Switzerland and Unilever are the two leading companies in the food sector in the ranking of the 1250 most important global companies with regard to R&D investment,[25] with annual R&D investment

23. CIDEM (2006): http://www.cidem.com/catalonia/cat/opportunities/foodanddrink/index.jsp.
24. With a figure of 2.4 billion pounds sterling. The countries that contributed most to R&D in the sector are Great Britain and Switzerland (with Nestlé). 2006 R&D Scoreboard. The top 800 UK and 1250 Global companies by R&D investment.
25. The R&D Scoreboard 2006. The top 800 UK and 1250 Global companies by R&D investment.

for the period 2005/2006 of 662.51 million pounds sterling and 654.8 million pounds sterling, respectively, representing 13% and 18% of their operating profits and 1.6% and 2.4% of their sales, respectively.

The volume of R&D investment by companies in this sector oscillates between 2.42 and 83 million euros, whilst turnover generally exceeds 350 million and in the highest case reaches 861 million euros (2005).

The innovation and R&D process in the company

With regard to the innovation process, we can consider there to be three different groups of companies. The first type includes one of the companies analysed, which does not conduct any R&D activity but does conduct activity related to process innovation. The second type is that of companies with an R&D centre or department in Catalonia that is only partly dependent on head office and has a certain amount of autonomy. Finally, the third type is that of companies that do not conduct R&D in Spain because they have specific research centres in other countries. The specific centres develop global innovations which are then adapted to local tastes; some of these companies have programmes that can be developed either at the centre itself or in the specialised centres.

Nestlé granulated coffee

At Nestlé Spain, R&D guidelines are received from Switzerland; despite this, however, the company retains a significant amount of autonomy in this area and focuses its R&D activity on improving knowledge with regard to consumer needs in order to adapt to these and improve communication with the consumer.
The two Nestlé factories in Catalonia are equipped with the most advanced technology. Some process innovations stand out in this. For example, the Girona factory produces granulated coffee with a patented manufacturing process that decaffeinates the coffee with water instead of chemical products. It is the only factory in Europe to use this advanced system.

Resources allocated to R&D

Indicators from the EU's Industrial R&D Investment Scoreboard demonstrate that the 1000 companies in the ranking increased their R&D activity by 5.3% in 2005, whilst the most important 1000 non-EU companies increased theirs by 7.7%.

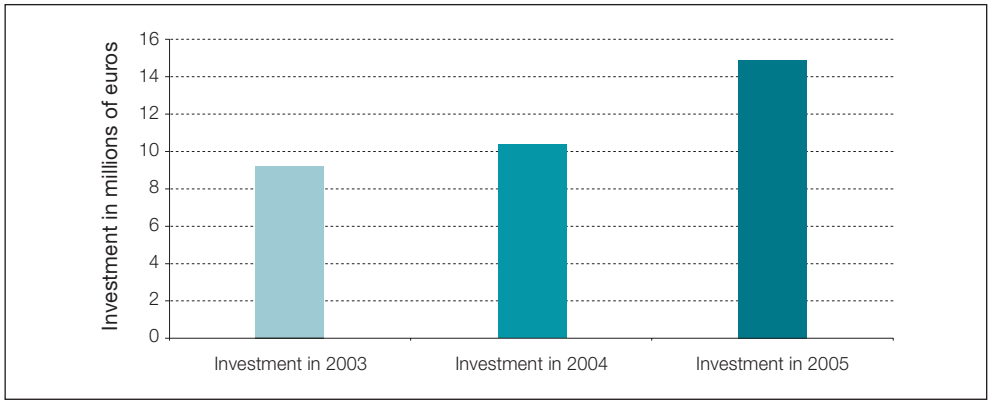
As far as the individual behaviour of the food companies analysed is concerned, there is a very diverse evolution in terms of R&D investment: there are annual increases in R&D investment of between 4.5% and 320%. In general, the number of personnel allocated to

R&D remains stable and oscillates between none and 20 employees working exclusively in the field of R&D.

Finally, number of patents cannot be considered relevant data in this sector and most of the eight companies either do not have patents or did not provide data in this regard. By contrast with this, trademark registration is relevant data and companies recognise this fact.

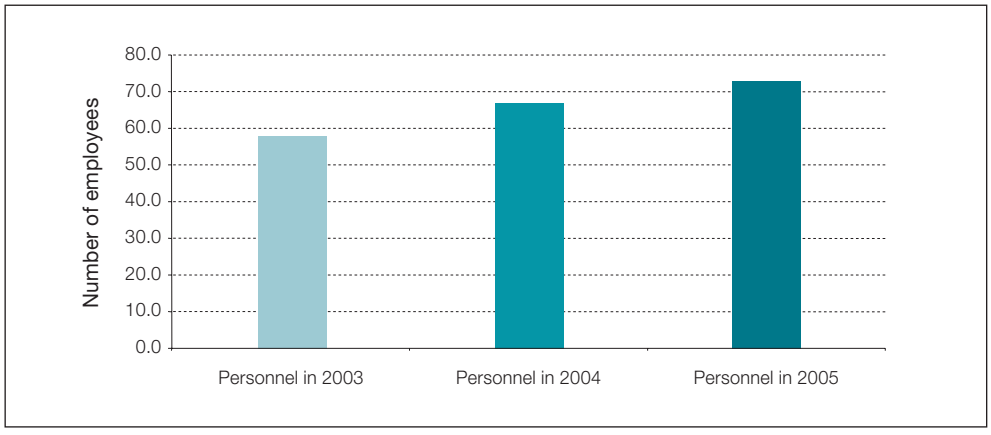
As can be observed in Figure 19, there was a positive evolution of investment in R&D by the companies analysed within the food sector between 2003 and 2005, the highest increase corresponding to the period 2004-2005.

Figure 19. **Evolution in R&D investment in the selected sample for the food sector (2003-2005)**



Source: Own data.

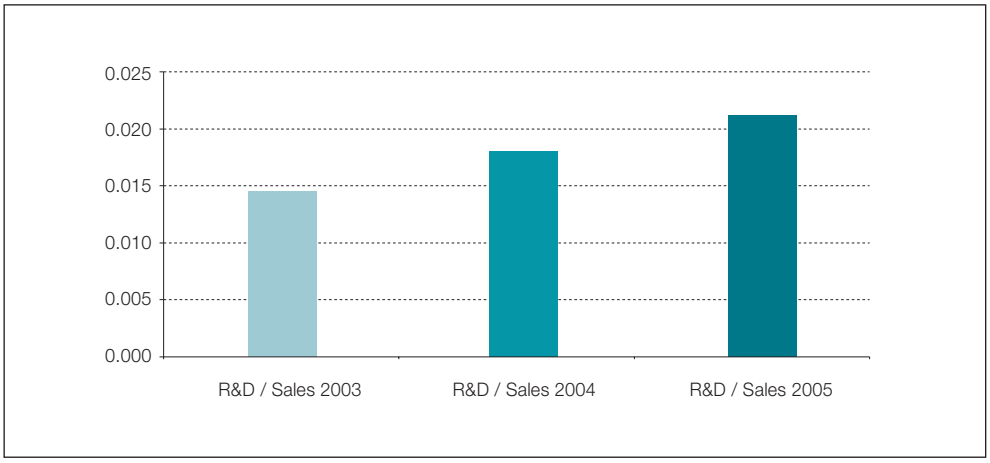
Figure 20. **Evolution in R&D personnel in the sample selected for the food sector (2003-2005)**



Source: Own data.

With regard to the number of employees exclusively allocated to R&D activities in the eight companies in the food sector included in the study, it is worth mentioning that there was sustained growth throughout the period analysed. Finally, as can be observed in Figure 21, the ratio of investment in R&D to sales between 2003 and 2005 also demonstrates a clear trend towards growth.

Figure 21. **Ratio of investment in R&D / Sales in the sample selected for the food sector**



Source: Own data.

R&D outsourcing and external support for R&D

With regard to R&D outsourcing, the group of companies analysed emphasise that R&D is a value-generating activity that can be conducted inside and outside the company, although some of these companies stated that it was difficult to find centres that conduct R&D activities more efficiently than when it is conducted in-company. They also emphasise that the need for confidentiality sometimes forces them to conduct R&D internally at the specialised centres of their mother company.

Despite this perception, some projects or special tests have been outsourced, in particular to universities, in order to complete some research and/or avoid investment in excessively expensive equipment which will receive little use.

External R&D financing

Only two of the eight companies managed to obtain external financing for their R&D projects in the period object of study. In one case financing was received from the Spanish Government, and in the other from the European Union (Framework programme). The main

reason some companies give to explain this low participation in public funding programmes is the aforementioned need for a minimum size of project and the lack of people dedicated to producing the required documentation. They believe that they need a larger organisational unit and at least one person allocated exclusively to producing documentation and maintaining contact with the government, a situation which is not true of any of the companies interviewed.

Opinions and comments

Due to its low technological intensity, the food sector has weak R&D indicators but conducts a significant amount of activity related to product and process innovation, also in the field of packaging. According to some managers, in this sector too little importance is awarded to innovation in comparison with that awarded to R&D. There is far more innovation than the statistics would suggest, otherwise the economy and the companies would not grow as they do. In some cases it is considered that there is a certain lack of connection between universities and companies and that there is a need for stronger relationships.

Some of the managers interviewed expressed their concern for the future of Catalan industry due to the small number of public resources it is allocated in comparison with the number allocated to services. Without R&D and innovation, industry will encounter great difficulties in the face of global competition.

Process innovation at Corporació Alimentària Guissona SA

Corporació Alimentària Guissona draws together all of the industrial and commercial activities of the Alimentari Guissona Group, such as the production of mixed animal feed, medications, agricultural machinery, abattoirs, meat and other products. It operates by means of extreme vertical integration.

The complete production cycle, which begins at the farms belonging to members of the co-operative, continues with the processing of the meat at the corporation's installations and ends in their «bonÀrea» shops. The product reaches the end consumer without intermediaries and with the maximum guarantee with regard to the origins and quality of the product certified by the ISO 9001 and ISO 22000 standards.

The group does not do any basic research, as in a sector as mature as the meat industry there is little margin for this type of research. However, they do conduct constant process innovation (reduced packaging, energy saving, logistical innovations, etc.). In 2006, for example, work was undertaken to develop a sophisticated logistical system for improving the efficiency of daily supply to sales outlets.

3.3.3. Automotive

Manufacturers

Sector context

According to data from the association ANFAC,[26] automobile manufacturing in Spain in 2005 represented 5.2% of Spain's GDP and employed 9.6% of the working population. Production totalled 2.75 million units, 81.6% of which were for export. Of the units produced, 20% were manufactured in Catalonia.

Spain is the third leading European manufacturer behind Germany and France, and the sixth in the world behind the two aforementioned countries and the United States, Japan, China and South Korea.[27] Of the 11 vehicle manufacturing companies in Spain, two have production plants in Catalonia.

It is worth mentioning that in this study we have not take into account the manufacturing sub-sector of motorcycles, mopeds and other related products.

The innovation and R&D process

Technological innovation in this sector is characterised by the development of new processes which are applied from the initial design phase of the vehicle onwards, employing a common platform for different models in the search for common parts and components, that is, the use of a maximum number of common components for all products. The aim is to reduce product development time to the minimum and lengthen design life so as to cut costs in this area.

During manufacturing, process innovations are also important for achieving high levels of productivity and quality. One example of this is applying management philosophies from the overall supply chain. Of the new practices there has been a generalised higher level of integration of suppliers in the final production chain,[28] and the company has even managed to make two or more suppliers produce and supply one component together.

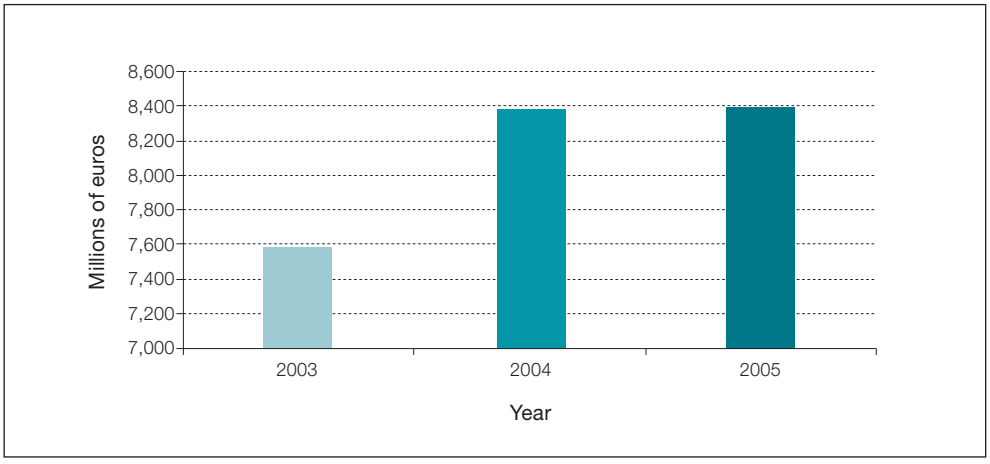
The trend has therefore been towards a reduction in manufacturing activities by the vehicle manufacturers, who have focused more actively on the design and integration and coordination of the final assembly so as to achieve cost reductions, improvements in quality and more flexibility in responding to market demand. The appearance of new commercial formulas, such as specialised wholesalers, distributor brands and specialised quick repair workshops, has contributed to accelerated changes in demand over recent years.

26. Asociación Española de Fabricantes de Automóviles y Camiones (Spanish Association of Automobile and Lorry Manufacturers).
27. Data from 2005.
28. Known as TIER 1.

Resources allocated to R&D

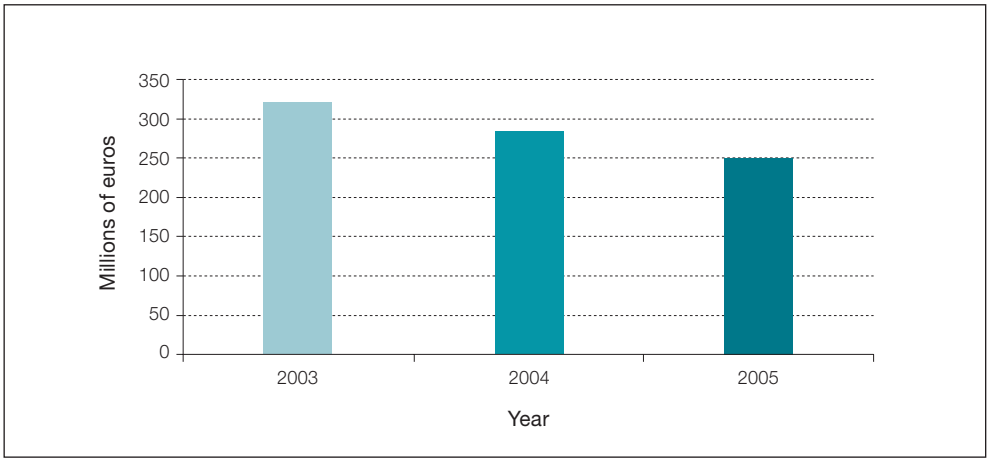
Graphs 22 and 27 provide the main results with regard to the sales and resources allocated to R&D by the companies studied.

Figure 22. Evolution in sales. Automobile companies. Manufacturers



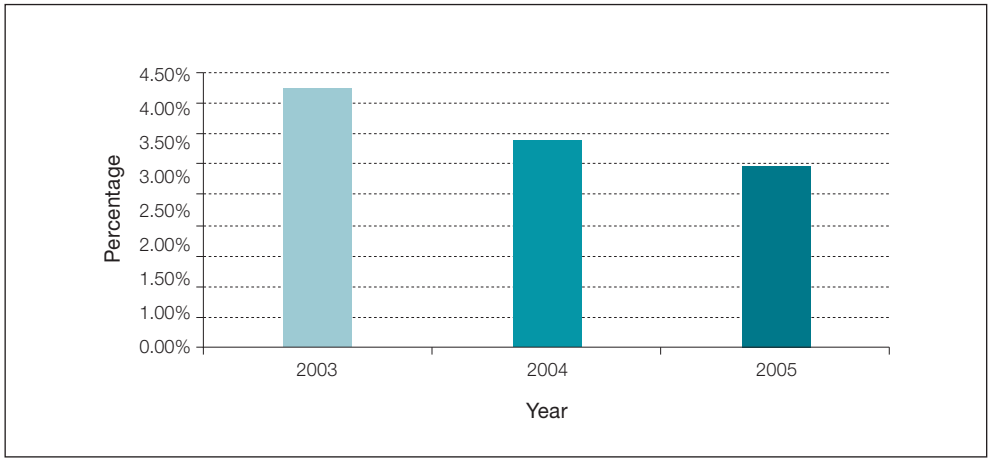
Source: Own data.

Figure 23. Evolution in R&D investment. Automobile companies. Manufacturers



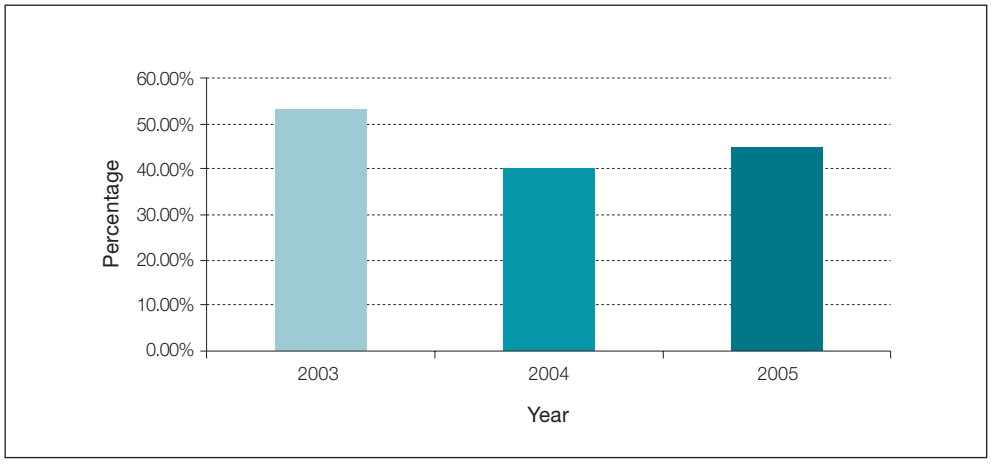
Source: Own data.

Figure 24. **Evolution in R&D investment / Sales. Automobile companies. Manufacturers**



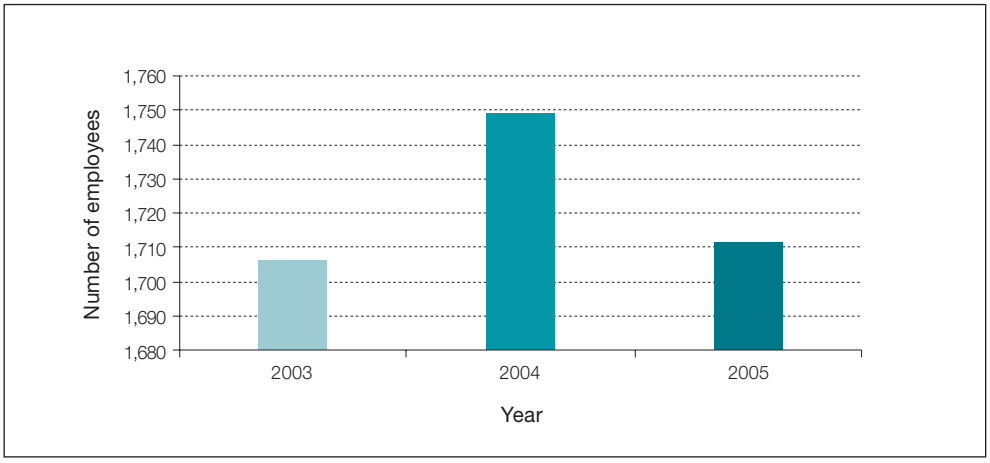
Source: Own data.

Figure 25. **R&D investment / Investment by the company. Automobile companies. Manufacturers**



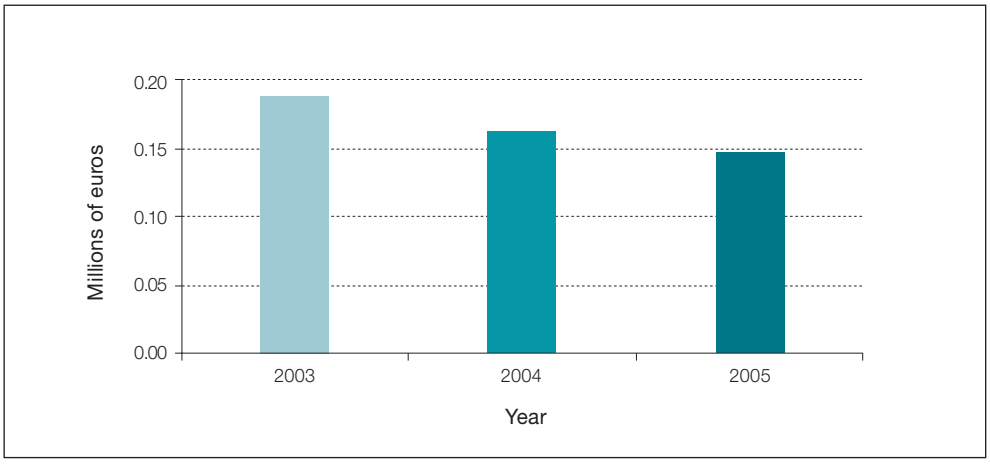
Source: Own data.

Figure 26. **R&D personnel. Automobile companies. Manufacturers**



Source: Own data.

Figure 27. **R&D Investment / Personnel. Automobile companies. Manufacturers**



Source: Own data.

As can be observed from the above graphs, investment in R&D (annual average value of 10.5%) and the ratio between R&D and sales decrease, although the percentage of R&D over total investment remains at an average level of 45%. The number of personnel allocated to R&D remained stable over recent years with minimal variations of around 2.5%.

The number of registered patents is lower than desired, as this is normally done by the mother company.

The innovation and R&D process

Automobile manufacturers have specific departments or companies for their R&D activities. These sections do not include production engineering: the vehicle platform, in most cases, comes from the company's central development centres, which means that the visible part of the automobile is constructed locally, representing approximately 60% of the value of the product. In any event, local R&D teams are highly dependent on decisions taken by the mother company.

R&D outsourcing

R&D outsourcing mainly consists of engineering tests and services. There is a high level of collaboration with universities and business schools.

Ancillary industry

Sector context

Turnover for the ancillary automobile industry in Spain for 2005 totals 30,000 million euros, 53% of which corresponds to exports. Sales to national manufacturers reached 10,000 million euros, the rest corresponding to the spare parts market. In the same period, Spanish imports of ancillary materials totalled 20,000 million euros, representing 40% of total volume.[29]

A large part of the Spanish ancillary automobile industry is based in Catalonia. This activity carries significant weight in the Catalan business world due to multinational companies, most of them European, moving here during the Eighties and Nineties attracted by low wage costs and also due to the growth of one or two companies from the region. Only one of the companies participating in the study is run with Catalan capital and has its head offices in Catalonia. The other companies belong to foreign multinational groups. All of them have plants in Catalonia and abroad.

Ancillary industry offers its products to two completely different markets: on the one hand, the primary equipment market aimed at new vehicles supplied directly to manufacturers, and

29. Source: SERNAUTO (Asociación Española de Fabricantes de Equipos y Componentes para Automoción - Spanish Association of Equipment and Component Manufacturers for the Automobile Industry).

on the other, the spare parts market aimed at vehicle repair workshops and private customers. These two markets behave in opposing cycles. Thus, a decrease in the sales of new vehicles reduces the demand for primary equipment, but has a positive effect on the spare parts market, as it increases the antiquity of vehicles on the road.

In recent years, the relocation of some companies has generated concern in the sector, which basically competes on cost and is governed by global agreements between manufacturers.

The innovation and R&D process

The ancillary industry operates on a pyramidal structure (TIER n) in which suppliers on the first level are normally large-scale multinational groups responsible for a whole vehicle group or system. Their production process is conducted using groups and parts provided from lower levels, with design and coordination tasks for all activities, allowing units to be obtained from one single organisation and assembled in the end product. We find two types of company within this structure. On the one hand, medium-sized and large companies, most of which are run with foreign capital, either totally or partially, and have their own products that they supply directly to the end manufacturer. On the other hand, small companies with few employees that form part of the so-called lower-level suppliers (levels 2, 3, 4, etc.) and which do sub-contracted work or manufacture parts and accessories. Many of these companies are mechanical workshops or family companies specialised in specific production processes.

Ancillary companies are experiencing profound change deriving from diverse trends in relationships between suppliers and clients. The former is the process of simplifying supply, which is changing from the supply of a simple part or component to a complex functional group or system, and modularisation, that is, the manufacturing of modules as a group of pre-assembled components. Components currently represent between 65% and 70% of the vehicle's added value. All of this means a transformation in the supply chain which involves a reduction in the number of first level suppliers of manufacturers or end assemblers.

On the other hand, the process of globalisation in the automotive sector has a very direct effect on the ancillary industry as it obliges these companies to have the sufficient technical, productive and financial capacity to respond to their global clients and to be located close to their decision centres and production plants. Thus, suppliers must locate themselves close to or even in some cases inside the production plant of the automobile manufacturer, in the so-called supplier parks, in order to adapt deliveries as far as possible to production needs.

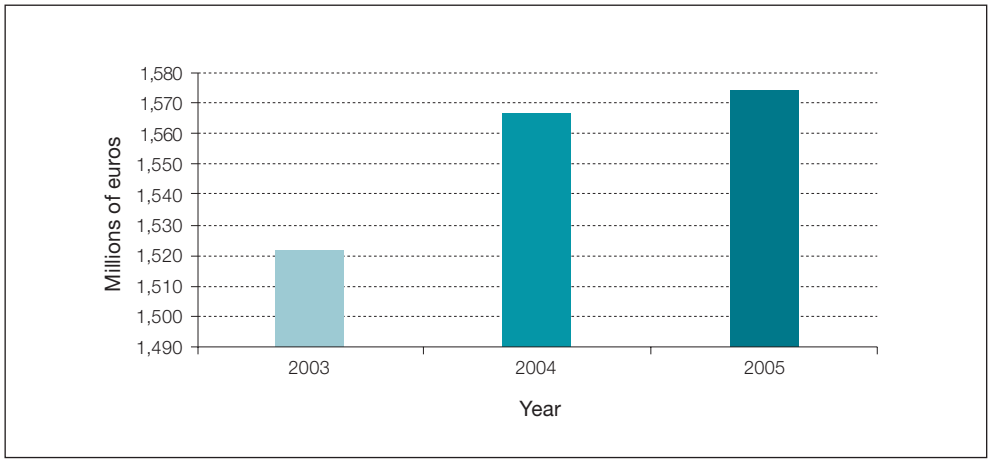
Resources allocated to R&D

Ancillary companies that form part of this study invested around 1.73% of turnover in R&D in 2005, varying from the sector average, which invested 0.6% of turnover in R&D. The

difference with regard to the Spanish average may be due to the fact that the large companies, which are the only ones included in the study, allocate a higher volume of resources to research projects.

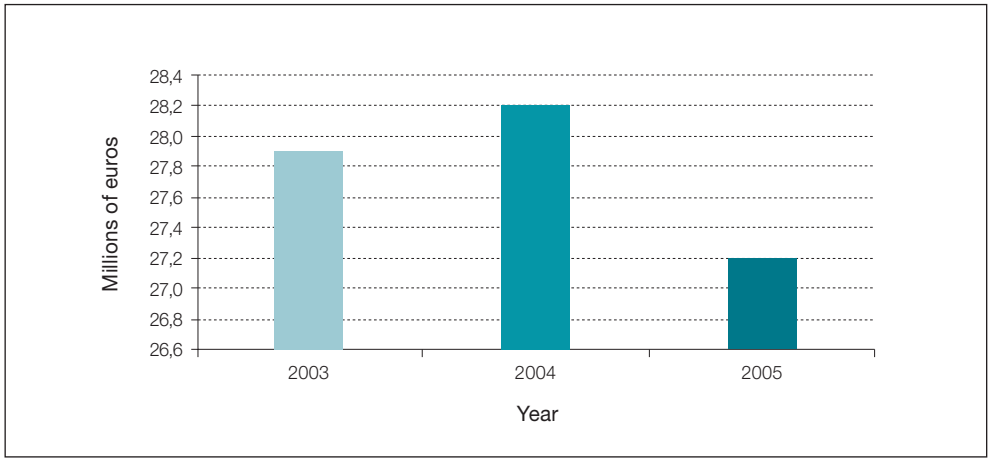
As can be observed in the following graphs, there has been a trend among the analysed companies to slightly reduce R&D investment. The ratio of R&D investment to sales decreases and is situated around 4.2% for 2005.

Figure 28. **Evolution in sales. Automobile companies. Ancillary industry**



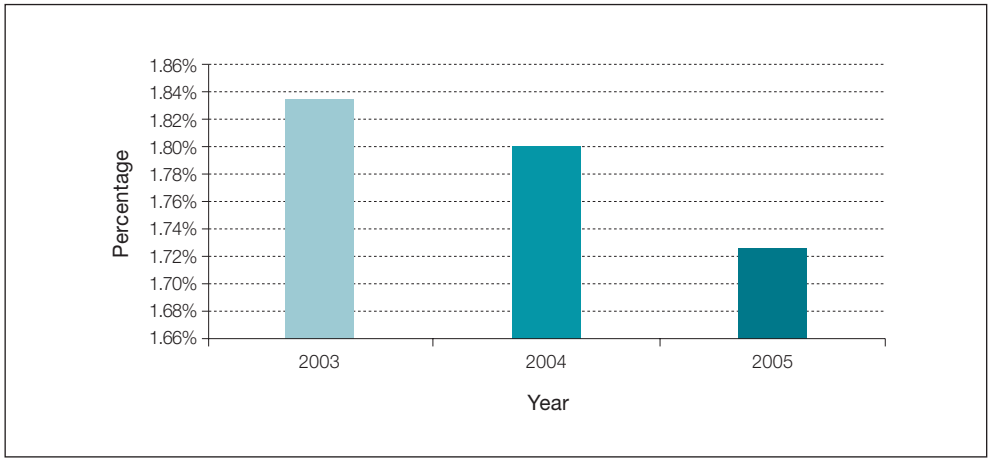
Source: Own data.

Figure 29. **Evolution in R&D investment. Automobile companies. Ancillary industry**



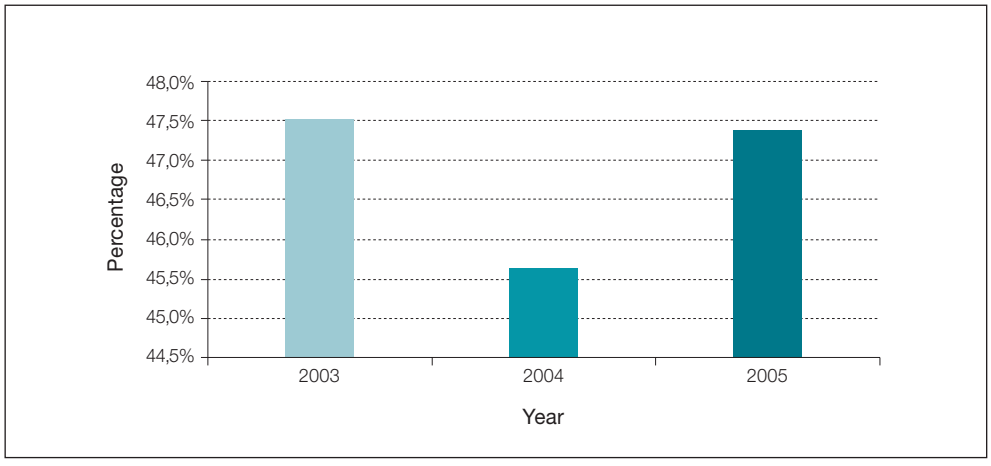
Source: Own data.

Figure 30. **Evolution in R&D investment / Sales. Automobile companies. Ancillary industry**



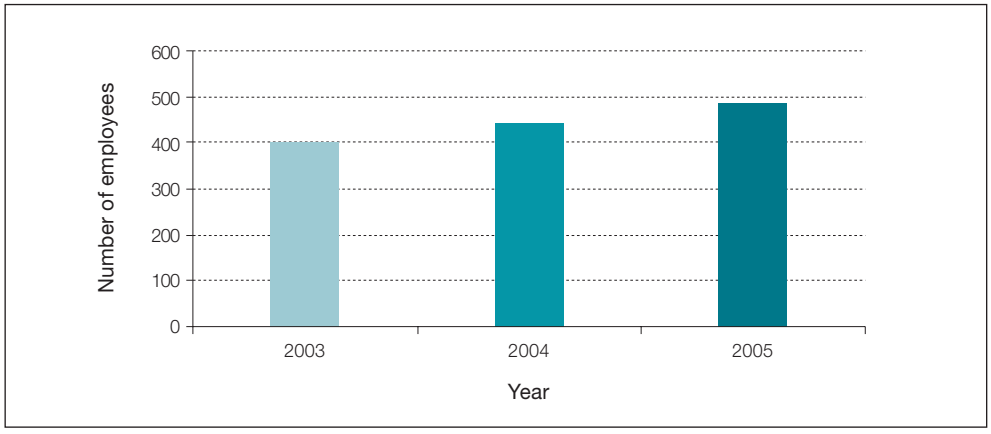
Source: Own data.

Figure 31. **R&D investment / Investment by the company. Automobile companies. Ancillary industry**



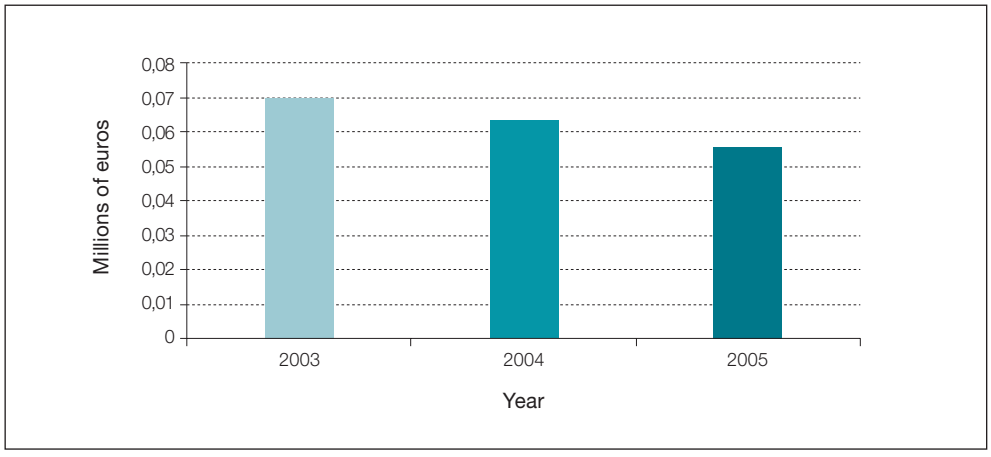
Source: Own data.

Figure 32. **Evolution in R&D personnel. Automobile companies. Ancillary industry**



Source: Own data.

Figure 33. **R&D investment / Personnel. Automobile companies. Ancillary industry**



Source: Own data.

It is important to state that all but one of the companies studied from this sector are foreign multinationals and their R&D centres are therefore mainly located in other countries. R&D activity conducted in Catalonia is focused on very specific aspects of product development and in particular production processes in particular. There is strong internal cost competition between plants of the same group located in different countries.

Once again the number of registered patents is below the desired amount as it is normally the mother company that registers them. There is one noteworthy exception, however: FICOSA Internacional, the only company of those studied that has a decision-making centre in Catalonia.

R&D outsourcing

The results of the study undertaken lead us to conclude that collaborations are entered into with universities that have particular involvement in new product development and the technological testing of current products.

External financing

With regard to the external financing of R&D activities, the companies studied have received financial help to finance their R&D investment projects in accordance with the subsidies established by CIDEM, the Secretariat for Industry, Profit and CDTI. The companies in this sector have problems obtaining European funding as this is mainly awarded to joint projects involving different companies.

Opinions and comments

Among the opinions collected from the interviews conducted with managers there is a growing recognition of the importance that the government contribute to R&D, although it is also true that certain aspects have been detected which the companies believe must be improved (in particular with regard to the application process and processing of financial aid). Furthermore, one company suggested it would be a very good idea if public administration were to create a cluster of automobile companies in Catalonia or Spain to allow companies to take more advantage of existing financial aid.

The ancillary industry. Two quintessential practices

The ancillary automobile industry has a very strong presence in the Catalan business world. Below are two clear examples of this:

PEGUFORM IBÉRICA

In order to carry out its innovation projects this company forms working teams comprising of its own professionals from different countries and supply companies. This allows it to emphasise common objectives regardless of where products are ultimately manufactured.

FICOSA INTERNACIONAL

This is the only company from this sector group with its head offices in Catalonia. Its strong entrepreneurial culture has brought very positive results in terms of copyright. The number of patents registered by this company from 2003 to 2005 exceeds an average of 700 per year.

Many managers also consider that technological training for the new generation of students on non-university courses should be improved by means of in-company work experience and that there should be promotion of more active collaboration policies between universities and companies.

Some managers also express their concern at having to adapt to the very rapid rate of change within the industry, believing that there is not enough of a support structure for Catalan business and that at times suppliers and partners are sought outside the region due to ignorance regarding the business activity of other Catalan companies.

In addition, significant changes are forecast for the sector due to the development of new engine technologies, requirements for greater vehicle safety and lower carbon dioxide emissions. The sector must be prepared to make the investment necessary to adapt to these changes. It is believed that the average increase in cost per vehicle will be around 3600 euros, which will have to be borne jointly by manufacturers and suppliers on the one hand, and car owners on the other.

Finally, logistical costs for transporting parts and automobiles during the production process and sale are estimated to make up 10% of the total, exceeding labour costs, which is why improvements to communications infrastructures are becoming a key issue in the sector.

3.3.4. Chemical

Sector context

Historically, the chemical industry has had an important presence in Catalonia. 10% of industrial wage earners[30] belong to this sector. This is due to the presence of very important multinational companies in the region in a sector in which, due to its characteristics, size is a relevant factor for competitiveness. It is well-known that the chemical industry is a capital-intensive sector and that in an international context it has been immersed in numerous mergers and takeovers in recent years. The dynamics of the sector in recent years in Catalonia have been positive and are globally reflected by the growths registered in terms of production, although we must not forget the trends towards rising costs (with oil prices being the obvious main reason).

The sector (excluding pharmaceutical activities) groups together very diverse activities. It tends to be divided, for the purposes of this analysis, into four large sub-sectors: the basic chemical industry, chemicals for agriculture, industrial chemicals and chemicals for consumption. The eight companies included in this study have activities in all four sub-groups.

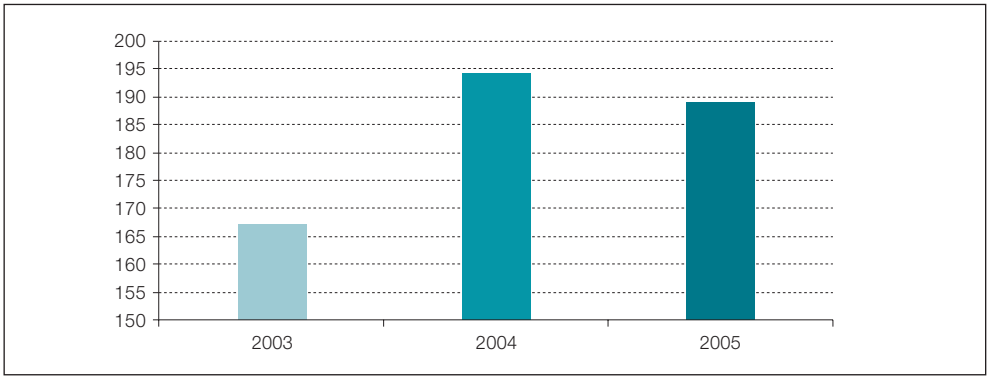
The chemical industry in Catalonia has an overall weight of almost 50% of the chemical industry for Spain. This weight is also reflected in research and innovation. Data from the

30. Annual report on industry in Catalonia 2005. Department for Work and Industry. Secretariat for Industry. Government of Catalonia. Barcelona.

recent study on industrial R&D in Catalonia[31] show that 50% of R&D expenditure in the sector in Spain corresponds to Catalan companies. A practically identical result can be found if we analyse expenditure on innovation in the data obtained from the survey on technological innovation conducted by the INE.

The eight companies from this sector included in the study have a long tradition in the region and were practically unaffected in recent years by significant international mergers or takeovers. Five of the companies are multinationals (Henkel, Basf, Bayer, Solvay and Clariant) and there are three groups with head offices in Catalonia: Ercros, Colomer, and Puig). It is worth noting that subsidiaries of multinationals are companies with diverse industrial installations in Catalonia and have a great historical tradition. Figure 34 demonstrates the evolution in terms of personnel (full-time) allocated to R&D for the group of eight companies. The evolution is basically irregular, as between 2003 and 2004 there was a large increase in the number of employees, whilst between 2004 and 2005 numbers decreased.

Figure 34. **Companies from the chemical sector included in the study. Evolution in personnel allocated to R&D**



Source: Own data. Number of people allocated exclusively to R&D in the companies in this group.

The innovation and R&D process

Accumulated R&D investment for the eight companies is around 15 million euros for 2005. It must be remembered that the chemical industry is not a high technology sector, but rather in the OECD classifications form part of the industries with «medium-high» technological intensity. Evidence of this can be found in the average indicator value for companies' R&D / sales, which for 2005 was around 0.59 (Table 7). Generally speaking, the different indicators (R&D investment, personnel, etc.) are very stable in the period object of analysis (2003-2005).

31. Solà, J.; Sáez, X. and Termes, M. (2006): «La innovació i l'R&D industrial a Catalunya». *Collection of Industrial Economics Papers*, no. 23. Department for Work and Industry. Secretariat for Industry. Government of Catalonia. Barcelona.

There is R&D activity in seven of the eight companies analysed. In the case of multinational groups, this is by nature very centralised R&D. In four of the five cases of subsidiaries in this sector group, however, there is very special emphasis by the companies when highlighting that, although they are a subsidiary, they have managed to maintain a certain level of R&D activity in Catalonia and that this, if viewed on an international scale for the respective company groups, is not within the reach of all subsidiaries. This situation is accompanied by concern for the fact that this R&D expenditure represents a very small proportion when compared to the company's turnover in Catalonia, but nevertheless has high significance within the context of the groups. The reflections of the four companies were very similar: it is precisely because good results have been obtained from the R&D conducted in Catalonia that the subsidiary is valued by the company and therefore receives recognition and prestige within the multinational group, which in turn opens (or may open) the door to possible improvements in allowances and infrastructures for R&D conducted in Catalonia. One R&D manager speaks of «visibility tools for the work accomplished». The receipt of awards and recognition from the Government of Catalonia, the Spanish Government or business associations also contributes to this. This view of recognition and prestige for the subsidiary from the head offices of the multinational group is an idea that, although with slight differences for each of the four companies, highlights a situation which for the 50 companies in this study has generally not been expressed by subsidiaries from other sector groups.

Outsourcing

Given the characteristics of a «science-based sector», the chemical industry has a long tradition of participating in publicly-funded R&D programmes and, to a greater or lesser degree, outsourcing these activities to other companies. Five of the eight companies analysed from the sector received some type of funding for R&D&i, although the figures are rather modest. The five companies that do provide details of some of their relevant agreements and collaborations mention the following institutions and companies: IRTA, IQS, UB, UAB, UL, URV, UPC, CSIC, ICIQ and AIMCRA, among others.

Scouting at Bayer

At Bayer Polymers, proposals for R&D activities and follow-up projects, when accepted, are made in Tarragona, whilst decisions on research collaborations are taken in Germany.
In the ICREA - Institució Catalana de Recerca i Estudis Avançats (Catalan Institute for Advanced Studies and Research) - selection process in 2005, Bayer Polymers was the only private company to obtain a place. Among other things, the researcher carries out «scouting» functions: his or her job is to investigate research centres in Spain in order to discover research activities that may be of interest for projects being conducted in Germany (Bayer internal R&D) and establish collaboration contracts, if applicable. His or her work also involves managing national aid (subsidies, etc.), managing information for the group's applications to participate in European-funded projects, which is done from Germany, and the coordination of R&D activities by the various collaborating groups.

With regard to multinationals, relations with the mother company regarding benefits from the central laboratories or infrastructures outside Catalonia are not normally reflected in R&D accounting. This only occurs in one case, although it is an important one and represents a little over 50% of the activity.

It is worth noting that two chemical consumption companies in the sample are companies with a very high turnover, focused mainly on cosmetic products and characterised by a very significant personnel expenditure within overall R&D expenditure. The use of public funding is particular significant in the case of one of the companies in 2003, but practically zero for 2004 and 2005. Both of these companies have signed various collaboration contracts with university departments at the University of Barcelona and both subcontract R&D to foreign centres due to their international size and the characteristics of their activities.

Finally, it is worth commenting that one of the opinions collected from this sub-sector group is the companies' perception that they are a «minority» sector and that this sector should receive more support and involvement from the government at specific times.

3.3.5. Pharmacy

Sector context

There was a growth in sales in the pharmaceutical sector in Catalonia between 2003 and 2005. At the same time prices decreased, due in part to the regulatory measures implemented by the government. As far as foreign trading is concerned, in 2005 exports recorded a notable high, a trend that characterised imports in 2003, in a change partly influenced by the incorporation of new members into the European Union in May 2004.

The pharmaceutical sector is one of the sectors with strongest traditions in Catalan industry, representing a large part of the sector's activity in Spain: approximately 45% of pharmaceutical laboratories and over 50% of fine chemical manufacturing centres in operation in Spain are found in Catalonia, representing 55% of national pharmaceutical production and over 50% of personnel employed.[32]

As highlighted by the aforementioned report, various different types of pharmaceutical companies are concentrated in Catalonia. The largest five laboratories in Spain are Catalan-owned multinationals - Almirall-Prodesfarma, Esteve, Ferrer Internacional, Lacer and Uriach. In this respect, it is worth commenting that four of these five laboratories form part of this study. Another type of company frequently found in this sector in Catalonia is the foreign multinational with its head offices or a plant located here, for example Sanofi-Aventis, the third largest pharmaceutical group in the world and the leader in Europe.

32. Annual report on industry in Catalonia. 2006. Government of Catalonia.

Table 31. Evolution in pharmaceutical sector variables for the period 2003-2005

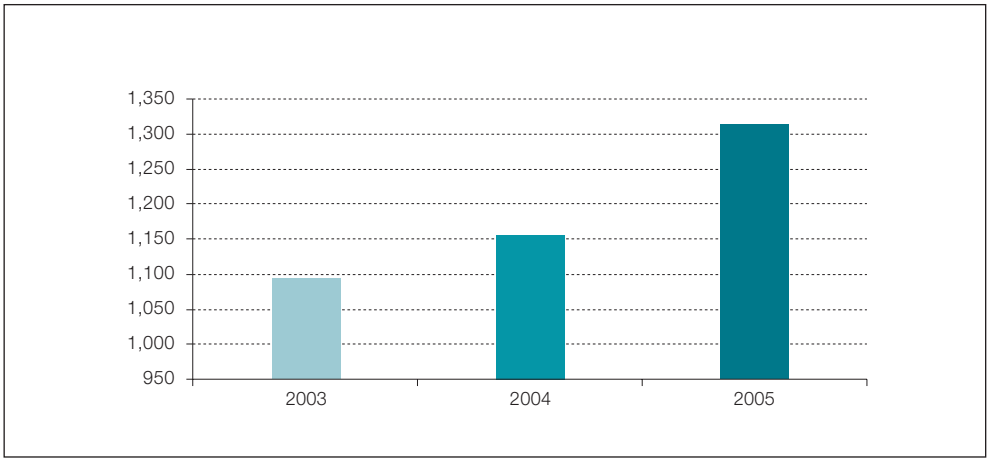
Variables	Evolution for 2003	Evolution for 2004	Evolution for 2005
Production	+	+	+
Employment	=/+	=	=
Prices	=/+	=/+	–
Exports	=/+	–/=	++
Imports	++	–	+

Source: Annual report on industry in Catalonia (2003, 2004, 2005).

The innovation and R&D process in the company

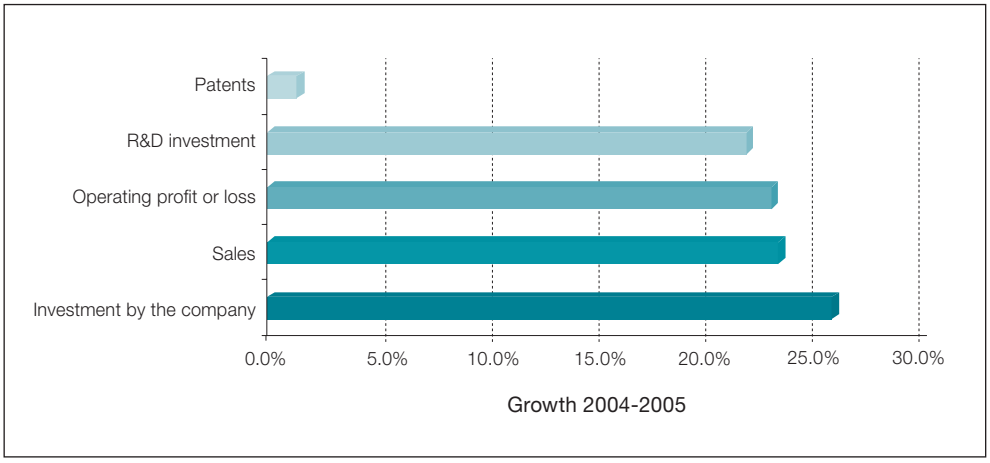
As this is a sector with high technological intensity, innovation and R&D require a high volume of investment. In the companies of the sample, R&D investment increased from 2003 to 2004, whilst in 2005 half of the companies slightly reduced investment. Despite this, there is a significant overall increase in investment by these companies. From 2003 to 2005 the average number of personnel employed in R&D was 156 people and there is little variation during this period; only one company significantly increases its workforce, by 15% in 2004.

Figure 35. Pharmacy sector companies analysed in this study. Evolution in personnel allocated to R&D



Source: Own data. Total number of people allocated exclusively to R&D in companies in the sample from this sector.

Figure 36. **Pharmacy sector companies analysed in this study. Evolution in selected variables**



Source: Own data.

Patents are very important in the pharmaceutical sector. The companies participating in this study have a high number of patents and applications at different stages (priority applications, applications for any country, awarded patents and patents currently in effect). In 2005, the four companies of the sample to provide data relating to patents had an average of over 450 patents currently in effect.

Outsourcing

Since the Nineties, models of innovation in the bio-pharmaceutical sector have undergone great change. On the one hand, research sources have diversified: from a research model concentrated on universities a change has taken place towards a model of cluster networks comprising a greater number of agents and of more varying types. On the other hand, by way of response to the competitive pressure of the increasingly more globalised markets, the product development phase has been accelerated, with the inclusion of research processes where there are parallel stages to save time, and there is a growing trend of subcontracting stages of research internationally. These changes represent more complex models of innovation (Imperial College London, 2006).[33]

As a response to this more complex scenario and increased competitiveness the Government of Catalonia has in recent years been promoting public aid policies for research into biotechnology and biomedicine. Thanks in part to this initiative (the «Catalan Biore-

33. Imperial College London (2006). Innovation models in the biopharmaceuticals sector. Tanaka Business School.

gion»), Catalonia today stands out as one of the most dynamic regions in this field in Spain, although research and industry of this type is still very much in a stage of initial development when compared to other regions of Europe (Germany, France or the UK). Some of the companies interviewed agreed in highlighting the success of this initiative due to the infrastructures, resources and tradition Catalonia already had in this field, and underlined the need for coordination between the pharmaceutical industry, universities, science parks, hospitals and other participating agents, as well as the continuity of the adopted policies.

External R&D financing

External R&D financing by the public sector for 2005 was approximately 13.4 million euros on average.[34] By origin, over 90% (12.2 million euros on average) are public subsidies from the Spanish Government, 5.4% European funds and 3.2% funds from the Autonomous Government of Catalonia. With regard to external R&D financing from the private sector (other companies, financial institutions, etc.), only one company declared a significant volume of this type of financing, of over 12 million euros.

Opinions and comments

As can be gleaned from the previous section, and in accordance with the opinions collected from the interviews, the companies agree on the fact that they would appreciate more aid from the Government of Catalonia, due to the high levels of R&D expenditure in this sector in particular. In line with this, the companies also agreed that they would like to collaborate more with the Government of Catalonia as well as believing that the correct approach when designing aid policies is to bear in mind that companies «do not conduct research projects in order to obtain aid, but to obtain results» and that «research will be conducted anyway, with or without public aid». Public funding programmes implemented in Catalonia are isolated events and tend to be projects by the Centre for the Development of Industrial Technology (CDTI) or the EUREKA programme.[35] Although outside the period of study, the four companies involved in a CENIT project (Consorcios Estratégicos Nacionales en Investigación Técnica - National Strategic Consortiums in Technical Research), obtained in 2006, highlight the importance of this in the radical change represented by the design of the programme: four years in length, a very significant volume of resources and a subsidy of 50% of the total cost of the project.

Foreign companies or business groups with head offices in Catalonia face a series of specific challenges due to their status as such. Three of the eight companies in this sector participating in the study are of this type. Representatives of the companies explain that

34. Five of the eight companies provided data regarding external financing.
35. EUREKA is a European intergovernmental aid initiative for corporate R&D&i which has the aim of promoting the competitiveness of European companies with technological projects aimed at product, process and/or service development with a commercial interest in the international market and based on innovative technologies.

patents are centralised and managed on a corporate group level in the mother company's country of origin. They also emphasise the strong international competition in the field of research: countries such as Hungary and Russia are now very competitive and Spain no longer enjoys as much of a competitive advantage due to lower costs that characterised it some years ago. The strong competition is not only in the markets themselves, but also between subsidiaries of the same business group. In order not to lose competitiveness within the network of companies of the multinational group to which they belong, the centres located in Catalonia must differentiate themselves in terms of quality, resources and/or speed. Being able to take advantage of public aid (whether regional, national or European) available in Catalonia is also an important competitive advantage of the location and works in favour of multinationals maintaining their R&D centres in Catalonia.

Finally, one of the companies expresses its concern with regard to the evolution of R&D taxation. Tax deductions for R&D are to be progressively reduced and end by 2012, with the exception of the Social Security allowance for researchers which, however, is a much smaller amount.

To sum up, the pharmaceutical sector is one of the economic sectors in which R&D is of more relevance and moves more resources. The trend towards globalisation has been very strong in recent years, particularly with regard to R&D. Furthermore, the government's pricing policies affect whether conditions for industry on the Spanish market are more or less favourable. In recent years, these prices have tended to reduce the industry's margins. It is now essential to guarantee that Catalan companies and foreign companies with head offices in Catalonia do not lose competitiveness in the future. Moreover, although industry may seem strong in Catalonia in the context of Spain, work must continue along these lines so as not to lose positions with regard to R&D. The Catalan Bioregion is viewed by many of the companies in the study as a positive initiative in pursuit of this. Generally speaking, the companies also agree in highlighting the importance of continuing with active policies to promote R&D.

The Catalan Bioregion

The Catalan Bioregion initiative is evaluated positively by the companies, due to the fact that Catalonia has infrastructures, resources and institutional support in this field. The pharmaceutical industry has played an important role in this project alongside universities, science parks and hospitals. Furthermore, it is important that it is well-coordinated and, above all, has continuity. Strategic planning is key in this respect.

3.3.6. Services and distribution

Catalonia's GDP grew by 3.9% in 2006, 0.6% more than the previous year. This growth is above that recorded by the European Union (2.9%), whilst the Spanish economy also shows an overall growth of 3.9%, 0.4% more than the value recorded for 2005.[36]

The services sector represents 73% of gross value added[37] in the Catalan economy. Together with construction, these two have been the sectors with the greatest impetus in recent years.

Until now the presence of multinational companies has not been a characteristic feature of the sector, probably because these are companies with more local activities and a value chain which is also more local than other industrial companies. By contrast, there is evidence that these large Catalan companies are moving towards internationalisation. Almost half of the companies studied have international activity conducted from Catalonia in addition to, as one would expect, conducting their activities in the rest of Spain.[38]

In this epigraph we have grouped the service companies together with the distribution companies. This grouping may seem surprising at first, but the interviews with these companies made it clear that they are similar in terms of R&D investment. It is R&D that is conducted principally on information technologies, data treatment and specialised software development for company use.

The companies that comprised the «services and distribution» sector group allocated 69.95 million euros to R&D investment in 2005, and had an average of 68 employees working in this area with a low level of external financing (2.7 million euros of their R&D expenditure were for external financing, as shown by Table 7 in Section 3.2). As demonstrated previously, within this analysis of 50 large companies, this sector group was the third largest in terms of R&D investment in Catalonia in 2005, behind the pharmacy and automotive sectors. In accordance with the OECD groupings by technological intensity, all of the companies in this group are included in the low technological intensity group.

The companies in this sector group are of a markedly Catalan character. The 10 companies studied were Abertis, Aigües de Barcelona, La Caixa, Cirsa Business Corporation, Endesa, S.A., Gas Natural sdg, S.A. (mother company), Grup Áreas, Grup Caprabo, Mango and Transports Metropolitans de Barcelona (TMB). The principal data for the sector group is summarised in Table 32.

Table 32. **Principal data for the services and distribution sector group**

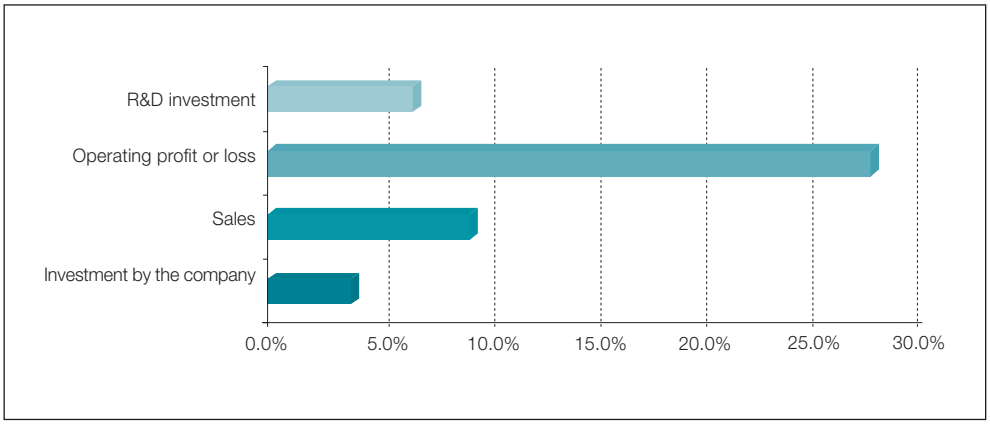
	2003	2004	2005
Investment in the sector	2,399.20	3,507.60	3,645.30
Sector sales	15,668.90	20,087.60	22,002.50
Operating profit or loss for the sector	2,423.10	2,944.30	3,782.40

Source: Own data. Figures in millions of euros.

36. Idescat: http://www.idescat.net/cat/economia/ecoserveis.html [Query: 10th April 2007].
37. Data from the «Pla 2005-2008 d'internalització de l'empresa Catalana», COPCA (Consorci de Promoció Comercial de Catalunya - Consortium for Commercial Promotion of Catalonia), Government of Catalonia. 2005.
38. Data on R&D investment have been distributed proportionately according to the activity conducted by each company in Catalonia or the rest of Spain. Our intention was to provide more reliable data on Catalonia.

The figures for 2003 reflect sales totalling 15,668.9 million euros, with 20,087.6 million euros in 2004 and 22,002.5 million euros for 2005. These data reflect a growth in sales of 9.53% over these two years, whilst total investment by the same companies totalled 3,507.6 million euros in 2004 and 3,645.3 million euros for 2005. The operating profit for the group of companies totalled 2,944.3 million euros in 2004 and 3,782.4 million euros in 2005. In short, there is a clear growth trend for these three figures.

Figure 37. **Percentage increases in the main figures between 2004 and 2005**



Source: Own data.

Over the last three years the levels of R&D investment made by the 10 companies studied has hovered on average around 55 million euros. This figure may seem low compared to other sectors, but it represents a high growth rate; thus, between 2004 and 2005 there was growth of almost 7%. We would like to point out that this increase is much higher than the increased operating profits for the sector and also higher than the figures for sales volume and total investment.

R&D activities by companies in the services sector are diverse, but we can summarise the main lines of action into four areas: improving ICTs, research into sustainability, improv-

Table 33. **Investment in R&D by service sector companies in millions of euros**

	R&D Investment 2003	R&D Investment 2004	R&D Investment 2005
Expenditure	33.03	65.47	69.94
Increase (%)			6.83%

Source: Own data.

ing performance in the activities in which the companies provide services, and accessibility to the services for clients and suppliers.

A cross-analysis of the amount of R&D investment with general data for the sector group demonstrates continued growth in R&D. Thus, in Table 34 we observe that all R&D percentages, whether relating to total investment by companies, sales or operating profit, grow over time, albeit not very significantly, although there is evidence of a trend towards greater significance for R&D activities in services and distribution companies.[39]

Table 34. **Evolution in R&D/Total investment, R&D/Sales and R&D/Operating profit or loss**

	2003	2004	2005
R&D/ Total investment	1.38%	1.87%	1.92%
R&D / Sales	0.21%	0.33%	0.32%
R&D / Operating profit or loss	1.36%	2.22%	1.85%

Source: Own data.

It would also seem that the strategic vision of companies in the sector awards an increasingly more central role to R&D activities. Many of the companies interviewed stated that they have started to produce medium or long-term R&D plans over recent years. For some companies this is part of their strategic plan, for others it goes by the name of a technological plan, or similar, and is restricted to isolated or short-term actions. Generally speaking, the trend of these companies is to establish medium-term plans and search for external financing for the proposed innovations and improvements.

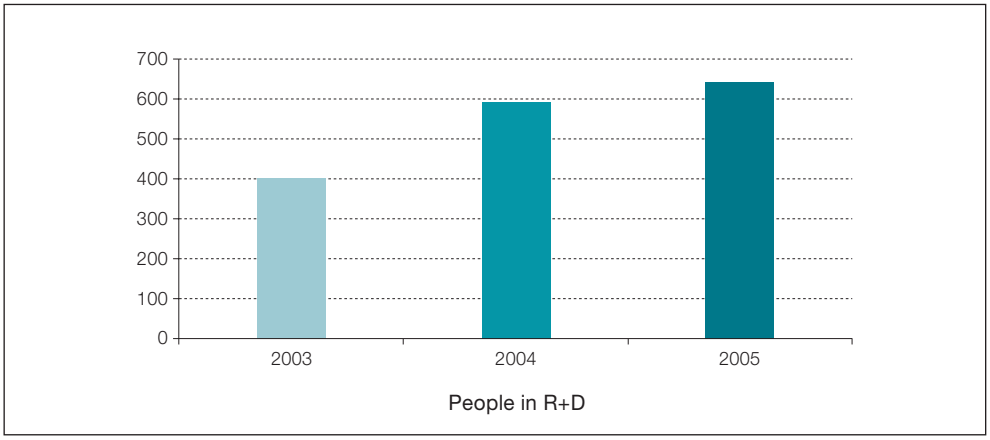
R&D actions tend to be conducted by the technological development department (or similar) created by many of the companies. They tend to have a small number of full-time personnel, 68 people on average, but it seems that the majority of companies are starting to formalise their R&D activity within the organisational structure itself. In addition to creating the R&D department (or another name, depending on the company), collaboration has been initiated with other departments, mainly management and marketing, to define the innovation and development actions to be taken by the company or subcontracted. On first view, this suggests that R&D expenditure will grow strongly in the coming years.

With regard to the number of employees working on R&D activities, two very different scenarios are identified, depending on the strategy of the company: whilst some companies have a large group of workers, in others it is hard to identify an actual R&D group or team. That is, there are two very different types of departments: companies with large R&D

39. With the exception of the ratio R&D / Operating profit or loss between 2004 and 2005, due to a very high increase in profits for 2005.

departments, with 150-300 employees, and companies with small R&D departments, where the number of employees varies between 3 and 30 people.

Figure 38. Evolution in personnel allocated to R&D



Source: Own data. Total number of people exclusively allocated to R&D work in the companies in this sector included in the study.

Where we find small R&D departments, these are sometimes cases of companies that do not make large R&D investments themselves and do not have their own personnel for this purpose, but rather subcontract this work and require suppliers to incorporate this into their products. That is to say, the companies force their suppliers to do the R&D activity. By contrast, other companies subcontract the R&D activities, considering that this option provides the group with strategic advantages.

There are two broad outlets for subcontracting R&D work: either to universities and research institutions anywhere in Spain or, as mentioned previously, setting conditions for suppliers to conduct the R&D and comply with the conditions imposed in contracts or specifications, depending on whether the company is private or public.

Within this sector group financing of R&D investment has mainly come from companies' own funds. The external financing of projects is not direct, which explains the fact that volume is not high and that companies must resort to self-financing. Much of the aid they have received has been for projects linked to sectors of activity other than services. During 2004 only 44.4% of the companies received external financing. This percentage dropped to 33.3% for 2005. By contrast, private financing behaved differently: in 2004 the percentage of companies in the services sector financed by this means was 11.11%, whilst in 2005 this percentage rose to 22.22%.

This external public funding came mainly from European projects—6.4%—and the rest from State projects. Of the part financed with European aid and projects, some companies

participated in European programmes in a more systematic way (Framework Programme, Eureka), or obtained aid from the Spanish Ministry through the Profit Programme. Public subsidies were small and discontinuous, as Table 35 demonstrates. Other companies dedicate part of their resources to financing these investments. It would seem, however, that this trend is moving towards an increase in external financing.[40]

Table 35. Services and distribution sector. Public subsidies

Volume of public subsidies	
2003	1.40
2004	4.65
2005	2.71

Source: Own data.

3.3.7. Other

This sector group covers a very diverse group of companies for which it was impossible to find a suitable grouping that suited our analysis. For this reason it is not possible to make a general comment on the set of characteristics and evolution in terms of R&D of the companies comprising this sector group.

The most notable subgroup is the one with three companies from the electrical machinery and material sector (Simon, Grupo General Cable and Schneider). Five of the companies are subsidiaries of multinationals and the other three are companies with their international head office in Catalonia (Simon, Indo and Ciments Molins). Two companies belong to the sectors considered to be of low technological intensity, cement and paper manufacturing, one of the companies is considered of high technological intensity and the rest medium-high technological intensity.

One of the more interesting reflections is that very diverse activities are allocated to this group but with significant links to environmental issues: the manufacturing of cement, paper, electrical material, turbines and railways. Half of the companies mention in one way or another the importance of R&D issues related to environmental impact or energy consumption.

External funding from public programmes (Profit, CDTI, etc.) is only used to any great extent by the three companies with the highest level of resources allocated to R&D: Indo, Simon and Alstom Transportes, who generally assess it positively. Their data significantly condition

40. Two examples of this: in 2005 nearly 50% of Gas Natural's external resources were publicly funded. In 2006, although this is not covered by our period of analysis, Abertis obtained a similar percentage of funding from European projects.

the average for the group. With regard to financing, the rest of the companies make very little use of public subsidies, either because they consider them excessively bureaucratic or because for the type of activities they conduct it is more difficult to take advantage of specific programmes: this is the case with the R&D related to «research into manufacturing processes» in large scale production plants. Finally, it is worth mentioning that there is evidence of contracts or collaborations with universities and external R&D centres in five of the eight companies.

The good practices of Indo

At Indo, the company and the R&D groups are divided into three business areas: lenses, frames and equipment. A total of 57 people work in the R&D departments of this «small» Catalan multinational which is very active in product design and development.
When it comes to outsourcing R&D activities they have been very active: work is being conducted on clinical assessment with the Valencia Biomechanical Institute at the University of Valencia, with the consultancy agency NODE in the field of the electronic development of electronic glasses and with the European Design Institute on product ideas. Industrial design is also subcontracted. Indo has taken particular advantage of the CDTI funding programmes and other public subsidy programmes, which are perceived as being very relevant to maintaining the company's competitiveness in R&D.

Opinions and comments

One of the companies states in relation to the field of electricity that in the specific case of Catalonia there are qualified research personnel and equipment, but that in electrical research support centres/installations there are some aspects that could still be improved upon in order to attract a higher number of tests and fully developed projects to Catalonia.

In the view of one of the managers interviewed, in certain cases where the product is considerably strategic for the country's economy and the government is an important client of the company that manufactures it, more advantage should be made of the government's negotiating power with the multinational, to attempt to influence the latter to reflect and calculate the R&D&i associated with the product in the Catalonia-based subsidiary.

Furthermore, despite improvements in recent years, for some managers there needs to be improvements in the unification of technological business networks in Catalonia in order for them to be able to support quality R&D. In some cases, there is little unity in the business world and ignorance of Catalan companies means that suppliers or partners are sought outside Catalonia. Such promotion of R&D is important to avoid companies becoming commodity manufacturers, as this could lead to competition on price alone and, in short, a possible future relocation of activities to countries with lower business costs.

4
CONCLUSIONS

ON THE ORIENTATION OF THIS STUDY

The R&D statistics tend to present a view of R&D in which Catalonia holds a noteworthy position in the context of Spain, but always starting from the consideration that resources allocated to R&D in Catalonia must continue to grow in the future, in order to place us at the same level as the regions at the head of the European R&D rankings. Within this view, there also tends to be emphasis on the fact that the weight of business R&D in Catalonia is clearly above the average for Spain, and practically at the same level as the European average.[41]

When it comes to R&D and innovation, studies have traditionally analysed SME's more than large companies due to the fact that their presence dominates the industrial fabric of Catalonia in quantitative terms. Furthermore, SME's have often been one of the priorities of public policies due to the difficulties they have in obtaining the necessary resources for conducting projects on innovation and R&D, difficulties that can be attributable to their size (SME).

This study, commissioned by CIDEM, starts from a different point: a view that focuses on the large companies in Catalonia by analysing the large-scale R&D activities of the 50 large industrial and service companies in the region. The companies that comprise this study are representative of the fabric of large business groups and the sectors that carry most weight in our economy.[42] These are companies that mostly have an annual turnover of over 500 million euros and consequently allocate important amounts to R&D in certain cases. The analysis also provides a dual perspective: subsidiaries of multinationals and non-subsidiaries, as these two types of company are both present to an equal extent in the selected sample.

Our aim was to obtain an additional view of the R&D conducted by these 50 companies. Despite the fact that some very specific companies on the list tend to publish their data regarding R&D expenditure, for the vast majority this is not the case. It is for this reason that the business groups were requested to provide their basic data with regard to R&D. Having this data available and complementing it with information obtained from interviews meant that we were able to provide a view of the scale of R&D activity in these companies, which was then completed with additional reflections on R&D from different perspectives. Above all, however, our

41. The R&D conducted by the companies in Catalonia represents 63.2% of the total, whilst for Spain as a whole the figure is 53.8% (2005 data).
42. Despite this, as highlighted in Section 2, two sectors are missing: consumer electronics and the graphic arts/publishing sector, as in both cases the companies selected did not accept our offer to participate in the study.

aim was to be able to compare the scale of R&D with the international scoreboard lists and to be able to provide a positive assessment of the challenges and opportunities that may arise from maintaining and improving the R&D conducted by these large business groups in the region.

In accordance with the guidelines received from CIDEM and as mentioned previously, we opted for a view of R&D using the most basic data as a starting point and we have used the methodological focus of international R&D scoreboard rankings in order to be able to identify how many of these large companies with their head offices in Catalonia have R&D activity comparable with the main companies in these international rankings.

The classification of companies participating in the study demonstrates the importance of five large sectors (understood in a broad sense): pharmacy, automotive, chemical, food, and services and distribution. In a sixth group, «other», we have grouped the companies from diverse sectors that did not fit into the five aforementioned sectors.

It must be borne in mind, however, that the fact that we were working with large business groups in some cases may lead to some problems with regard to «boundaries», given the diversification of activities existing in some of the companies. In any case, it is worth noting that ten of the companies belong to the group we have called services and distribution.

On the scale of R&D conducted by the companies

In 2005, the 50 companies studied allocated a total of 631.32 million euros to R&D investment and the total number of personnel working exclusively in R&D totalled 4,595 researchers. It is worth noting that totals are much higher among companies from the automotive and pharmacy sector groups, which represent 81% of the total R&D investment. However, this fact does not diminish the significance of some of the results highlighted below:

— Of the 50 large companies analysed, 47 conduct R&D activities. This result is particularly noteworthy if we bear in mind that half of the companies belong to multinational groups.
— Of the 50 companies, 23 would make the European R&D Scoreboards for 2005.[43] It should be noted that among these 23 we find all of the companies from the pharmacy group (8), half of the companies from the automotive group (4) and half of the companies from the services and distribution group (5). Furthermore, it is also worth highlighting that in the case of the pharmacy sector, the quintessential high-technology sector, of the eight companies that form a part of the 50 analysed, five would also make the top 500.

43. The R&D investment threshold for entering the top 1000 on the European R&D Scoreboard for 2005 was 2.67 million euros.

— Of the multinational subsidiaries included in the study (25 companies), ten have levels of R&D investment that position them in the top 1000 on the European R&D Scoreboard for 2005, with their mother company within the top 100.
— R&D activity for the period object of analysis, 2003-2005, demonstrates a significant growth in R&D (in investment or personnel) in most of the sectors, except for the automotive sector.[44] Two pieces of representative data: if we disregard the automotive sector, the joint growth in R&D investment for the rest of the companies between 2004 and 2005 reaches 17%. A second piece of data: 19 of the 50 companies have investment growth of over 5% between 2004 and 2005.

Some reflections for policies

On first view, assessment of these 50 companies does not to provide data that would lead to the forecasting of pessimistic scenarios with regard to R&D in Catalonia, rather the opposite. Despite the limitations inherent in the fact that we are referring to only 50 companies, we must take into account the weight these represent with regard to overall R&D expenditure in Catalonia.

From the analysis of all of the data obtained and reflections collected from the different R&D managers or executives interviewed, we believe that it is worth highlighting some relevant issues relating to maintaining or increasing studies to monitor this R&D by the large companies, given their importance to the region.

A change in the scale of subsidies?

Furthermore, in sectors where there is little technological intensity, such as food, little advantage is taken of external financing for R&D activity by the companies included in the study. The general comments made with regard to this issue are that in order to obtain subsidies they would need a larger scale of R&D activity that would allow them to have personnel allocated to preparing subsidy applications, something which for now seems impossible. This view of a sector where there is a significant presence of multinationals contrasts with the view of companies in the chemical sector (which also has a strong presence of subsidiaries), where the R&D assessment made by the subsidiary group in Catalonia as opposed to the group head office is viewed as a markedly strategic issue. This contrast poses new questions to which answers should be sought.

In another respect, the national government's implementation of the CENIT programme in 2006 was viewed as a very positive initiative by the various R&D managers of the companies with high levels of investment, despite the fact that 2006 did not form part of the peri-

44. Although the aggregated data for this sector must be interpreted with caution due to the differences in volume and type of R&D existing between vehicle manufacturers and component manufacturers (see Section 3.3).

od of analysis. The programme highlights two fundamental aspects of the direction of public support valued positively by these companies: the scale of the subsidies and the planning timeframe of four years. What is more, it has also led to the creation of consortiums between companies of the same sector, essential in addressing specific types of research for cost reasons, and yet unthinkable just a few years ago. Naturally, the R&D aid support lines promoted by CIDEM and the Secretariat for Industry and Enterprise, part of the Government of Catalonia's Department for Innovation, Universities and Enterprise, were also viewed very favourably by the companies.

Finally, the automotive sector includes very important companies facing the need for numerous investments related to new market needs and regulations: greater vehicle safety, fewer CO2 emissions, and customer demands for quality and new functions. In this respect, the creation of truly relevant automotive R&D business networks is one of the options proposed by some companies to allow them to take greater advantage of economic aid and respond to some of the more imminent technological challenges that must be addressed. There is another important issue that falls outside the scope of this study: the importance of communications infrastructures for a sector in which logistical costs are on the increase.

R&D conducted by subsidiaries

None of the subsidiaries included in the 50 companies in this study is in a delicate position within their multinational group that might lead to the consideration of possible processes of industrial or R&D-related disinvestment. Furthermore, these are companies with deep roots, often with different plants in Catalonia. Particularly in the sectors where there is more intensive R&D, however, when the R&D conducted by a subsidiary of a multinational is of an excellent standard it is a very valuable asset for the region. Valuable because of its links, in many cases, to R&D centres in Catalonia, but also because, however small it is, if the research is excellent, it may receive greater support from the multinational group in the future. In this respect, the receipt of aid for R&D, awards or recognition and taking advantage of support programmes for the incorporation of new researchers are indicators that allow the subsidiaries of multinationals to be valued and stand out for their competitiveness in research within the multinational group, something which is often very difficult to achieve.

R&D conducted by service companies

Another aspect we feel obliged to highlight relates to the sector we have called «services and distribution». Half of the companies that form a part of the study have levels of activity in Catalonia similar to those of the top 1000 on the European Scoreboard. The quantitative data show a very high level of R&D activity relating to information and communication technologies (ICT's) and the interviews provided further evidence of this. In other words, the label of «economic activity of low technological intensity» corresponding to these companies due to their being «services and distribution» companies makes very little sense. If the

internationalisation of these companies has been remarkable in recent years, it is thanks to some significant investments in very technology-intensive areas which, on the other hand, seem not to fit too well with public aid programmes for R&D&i. It is true that, for obvious reasons, competitiveness analyses have shown increased interest in «services innovation» in recent years and it is also true that this issue has progressively become the growing object of attention for policymakers. From our point of view, however, work must continue to more clearly incorporate this type of R&D linked to service and distribution activities into public aid programmes.

Changes in R&D taxation

Finally, it is also worth commenting on the issue of how the taxation of companies' R&D will change from 2012 onwards. This is an important matter, especially for companies with a very high level of R&D expenditure. It is not at all clear whether the change of system will leave a new situation that reasonably compensates the previous situation. It is therefore another factor to continue to take into account.

5 APPENDICES

5.1. CLASSIFICATIONS

Table 36. **Sector groups used in the study**

Sector group	CNAE codes for companies included in the group
Pharmacy	244 Manufacture of pharmaceutical products
Automotive	341 Manufacture of motor vehicles 343 Manufacture of non-electrical parts, pieces and acc. 25 Manufacture of rubber products and plastic material
Food Chemical	15 Food and drinks industry 24 Chemical industry
Services and distribution	52, 55, 60, 65*
Other	31 Manufacture of electrical machinery and material 33 Manufacture of optical instruments, etc. 352 Manufacture of rail material 29 Machinery construction
	26 Man. of other products made of non-metallic minerals 21 Paper industry

* The diversity of the 9 companies in this group corresponds to a very broad list of codes which is not detailed in the table due to its complexity.

Table 37. **Classification according to OECD technological intensity**

	CNAE codes
High technological intensity	244 Manufacture of pharmaceutical products 33 Manufacture of optical instruments, etc.
Medium-high technological intensity	24 Chemical industry 31 Manufacture of electrical machinery and material 341 Manufacture of motor vehicles 343 Manufacture of non-electrical parts, pieces and acc. 352 Manufacture of rail material 29 Machinery construction
Medium-low or low technological intensity	25 Manufacture of rubber products and plastic material 26 Man. of other products made of non-metallic minerals 15 Food and drinks industry 17 Manufacture of textiles and textile products 18 Clothing and leather industries 21 Paper industry — Services (diverse CNAEs)

Table 38. OECD technological intensity classification

Classification of manufacturing industry based on technology	
	ISIC Rev. 3
High technological intensity industry	
Space and aeronautical construction	353
Pharmaceutical products	2423
Office machinery and computers	30
Radio, television appliances and communications equipment	32
Medical, precision and optical instruments	33
Medium-high technological intensity industry	
Electrical machines and appliances	31
Manufacture of automobiles, trailers and semi-trailers	34
Chemical products, except pharmaceutical products	24 excl. 2423
Rail material and other transport equipment	352 + 359
Machines and materials	29
Medium-low technological intensity industry	
Coke production, refined petroleum products and nuclear fuels	23
Rubber articles and plastic materials	25
Other products made of non-metallic minerals	26
Ship building and preparation	351
Base metallurgic products	27
Metal manufacturing, except machines and material	28
Low technological intensity industry	
Other manufacturing and recycling industries	36-37
Paper, graphic arts and publishing	20-22
Food, drinks and tobacco	15-16
Textile, clothing, leather and footwear	17-19
Total manufactures	**15-37**

Source: OECD, ANBERD and STAN database, May 2001.

5.2. SCALE AND SCOPE OF THE R&D INVESTMENT SCOREBOARDS

On the R&D investment rankings and their compilation

The international R&D Investment Scoreboards have been produced by Company Reporting Ltd. since 2003. This company provides the European Commission with data for European and non-European companies in order to compile the EU R&D Industrial Investment Scoreboards,[45] and also passes data on to the UK's Department of Trade and Industry (DTI),[46] which publishes an annual report with similar data, including a chapter dedicated exclusively to British companies.

The methodological notes to these two benchmark reports are similar, due to their sharing the same data source. We do not intend to reproduce them in detail here, although we do feel it is important to highlight some of the issues relevant to understanding the characteristics of the «R&D investment» data that appear in the rankings.

The rankings provide us with some very interesting information, although comparisons must be made with caution. The following considerations encapsulate the reasons for this caution we recommend and the authors of the international scoreboards themselves recognise in the methodological notes to which we have referred.

On the R&D-related data available in the International Scoreboards

The company data appearing in these scoreboards were obtained by Company Reporting Ltd. (the company that manages these databases) from the companies' annual public reports and records. With regard to the compilation of these databases, it should be noted that:

— Wherever possible, the company managing the databases takes into account aggregated international data for each business group, although when these are not published it is possible that different companies from the same international business group appear in the rankings.
— The companies are allocated to the country where they declare their head offices. This does not always coincide with the location of production plants and R&D laboratories (for example, EADS has its head office in The Netherlands).
— Companies that do not present any type of data relating to R&D in their reports or only present excessively generalised information and not included in the scoreboards.
— Accounting practices and treatment of R&D differ according to the country. For Company Reporting Ltd.[47] «in many countries R&D is integrated into operating costs and it is not easy to separate them». It is for this reason that they consider some coun-

45. http://iri.jrc.es/research/Scoreboards_2006.htm.
46. http://www.innovation.gov.uk/rd_Scoreboards/.
47. Cf. Methodological note in the appendix to the EU R&D Industrial Investment Scoreboard.

tries from southern Europe and the new member states to be underrepresented. The gradual adoption of the IFRS (International Financial Reporting Standards) should contribute to this situation being corrected in coming years.

— Very diversified business groups have their R&D allocated to only one specific sector. This restricts analysis and comparisons and means that in some sectors not all of their R&D is listed. As a consequence of this, these sectors are undervalued in terms of R&D.

— The rankings also generate some confusion with regard to the period they cover, with the 2006 R&D Scoreboard including data from «the 2005 financial year». This is due to the diversity of situations in different countries and the fact that in some cases this «2005 financial year» refers to company data from mid-2005 to mid-2006.

On how R&D is measured on the international scoreboards

— In the scoreboards some companies include new product engineering costs within R&D data, which in the strictest sense should not be taken into account. This tends to happen with US companies in particular and generates a certain overvaluation.

— Despite the existence of OECD reference manuals for measuring R&D and innovation (the Frascati and Oslo Manuals, respectively) different interpretations exist with regard to what can be considered R&D. For some companies, certain processes are considered R&D whilst for others they are «engineering» or «innovation».

— Furthermore, there is also a difference between the R&D «investment» rankings and the R&D activity calculations in the OECD statistics. The OECD calculates total R&D expenditure, whilst the rankings only use own investment and disregard external financing. Neither is it clear whether companies should be specific about this issue in their reports.

The conceptual view and scope of our study

As stated in the introductory chapter, the CIDEM initiative of establishing an R&D investment ranking (R&D Investment Scoreboard) should be situated within the objectives of making available in Catalonia indicators that can be compared with those being produced on an international scale. In any event, and in relation to the two previous sections on international scoreboards, the following considerations should be taken into account for this study:

— In the strictest sense, the scoreboard rankings include companies' «own» R&D investment, that is, discounting external financing. The information request form was produced for this reason, to separate the two concepts.

— In Spain, the fact that over recent years the term R&D&i has become widespread means that some companies have included data referring to R&D&i in their respons-

es. In these cases an estimated value has been requested for «i», which has then been discounted. It is probable that in some cases this «overvaluation» may not have been corrected due to a lack of information from the companies.

— By contrast with the above, in some cases companies' interpretation of the concept «investment» was limited to equipment. This happens when, as highlighted in the methodological note to the scoreboards, companies have R&D that is very much linked to operative processes and is not treated as a «project» or is partially treated as a «project». In these cases the main problem is an undervaluation of the cost of personnel dedicated to R&D.

— Finally, one further element conditioned the information request form we submitted to companies: requesting data relating only to Catalonia. When the company conducted R&D outside Catalonia this was normally stipulated. 20% of the companies did not have detailed information and made an estimation which was translated into a certain percentage on the information request form.

The information request form, of which a copy is attached in the following section, requested three general pieces of information in the section «other data»: investment by the company, sales figures and operating profit or loss. The aim was to attempt to compile additional indicators if the level of response allowed this. Given the characteristics of the responses, we opted to use only data related to sales and use the relative experience of obtaining the other two data for a possible future republishing of the study.

5.3. FIELDWORK DOCUMENTATION

5.3.1. Institutional letter sent to companies

COMPANY
The General Manager
Address

Barcelona, 7th November 2006

RE: Request for collaboration on a study into the R&D conducted by large companies in Catalonia

Dear Sir/Madam,

Innovation and R&D have been recognised in recent years as key factors in business competitiveness. In the context of a globalising economy, the role of large business groups with regard to R&D has become essential for regions' economic development.

CIDEM has commissioned a joint team from the University of Girona and the University of Barcelona to conduct a study into «R&D investment by the 50 largest companies in Catalonia». The aim of the study is to research the nature and characteristics of the R&D conducted by this type of company and make available a quantitative and qualitative analysis that contributes relevant elements for reflection on the possible redirecting of R&D and innovation policies in Catalonia.

The study has been structured according to the main sector groups and your company forms part of the list of selected companies. We would like to request your kind participation in this study.

Over the coming weeks, Mr./Ms. ....., representing the team conducting the study, will contact you (or the person you designate) in order to enquire as to whether it is possible for you to accept our request. Naturally, any data and opinions you may provide will always be treated in an aggregated and confidential manner and will be of high value to the study.

The team will request a brief interview with the most appropriate person or persons in your business group for dealing with matters related to the R&D conducted by your business group in Catalonia. The maximum anticipated length of the interview is forty-five minutes.

You will receive a phone call after the second week in November to ascertain whether your participation in this project is possible and, should this be the case, to attempt to establish a date for the interview.

Thank you for your time,

With regards

Joan Romero
Director of Planning
CIDEM

5.3.2. Contents of the information request form

R&D investment by the 50 largest companies in Catalonia

Name of company or business group

If it is a business group which has different data for different group companies, as far as possible please complete one form for each of the different group companies. This is very much appreciated.

R&D investment in Catalonia*

	2003	2004	2005	Observations
Investment in R&D (millions of €f) (excluding external financing)				
External R&D financing				
Personnel allocated to R&D (number of people equivalent to full time)				
Registered patents (number)				

*Please note: If the data you enter in the table are for the group on an international level or for Spain as a whole, please provide an estimated percentage of R&D investment made in Catalonia in the observations column («R&D investment» includes all R&D expenditure).

External R&D financing (millions of euros)

	2003	2004	2005	Observations
Breakdown of external R&D financing, if available				
Public: European Community Spain Catalonia				
Private: other companies, financial organizations, etc.				

Participation in European R&D programmes (Framework or Eureka Prog.) (Funding received, in millions of euros)

	2003	2004	2005	Observacions
European programme projects conducted in Catalonia				
Programme:				
Programme:				

Outsourcing of R&D activities (other companies, R&D centres, universities...)
Please list the 3 most important initiatives for the period 2003-2005

Research centre / University / Company	Type of activity / Project	Approximate volume of contract

Other data (in millions of euros)

	2003	2004	2005	Observations
Investment by the company				
Sales figures				
Operating profit or loss				

Please return to: XXX@univ.edu or fax: YYY or postal address ZZZZ. Thank you.

The Universities of Barcelona and Girona and CIDEM will always treat any data and opinions companies may provide in an aggregated way and will under no circumstances publish or diffuse disaggregated data without the authorisation of the company.

5.3.3. Interview guide

Study of R&D investment by the 50 largest companies in Catalonia

Aims

R&D is an object of special attention for competitiveness analysis. Regional, national and European business rankings allow us to ascertain which companies have the highest sales volume or capitalisation, but they rarely reflect R&D investment. The aim of this study is to collect information from the 50 largest companies with their head office in Catalonia in order to be able to make aggregated comparisons based on sector and country in the same way as the so-called R&D scoreboards.

A team from the universities commissioned to carry out the study will conduct an interview to address the R&D of your business group. The interview will have a maximum anticipated length of forty-five minutes. In addition, you will be requested to complete a form with basic R&D data.

Interview guide

1) The company's innovation and R&D processes

   — The general characteristics of the company's innovation activity (or the business group's), overall and in Catalonia.
   — The R&D department (or departments) and their characteristics.

2) Resources allocated to R&D, expenditure, personnel…(see attached form)

   — Available aggregated R&D data for the business group (total and Catalonia).
   — Is data available for different group companies? Could you also provide us with these data?
     • Investment in R&D (excluding external financing).
     • External R&D financing (government, other companies…).
     • Personnel allocated to R&D (edp).
     • Protection of technology (patents).

3) Outsourcing of R&D and external support for R&D (see attached form)

   — Main processes for outsourcing/subcontracting R&D activities (other companies, R&D centres, universities, etc.). Characteristics, strategies…
   — Breakdown of external financing for R&D, if available (public, private…).
   — Participation in European R&D projects (Framework or Eureka programmes).

4) Other indicators

— Are indicators used for innovation activity?
— Processes for acquiring technology. Would you like to highlight any point here (company purchases, group holdings, for example)?
— The company's international technology strategy. Brief overview.
— Use of support tools and units (security, creativity…).
— General investment data for the company.

5) Opinions and comments

— The hold R&D has in the region. Perception of the managers interviewed with regard to factors that justify the company's current situation with regard to R&D.

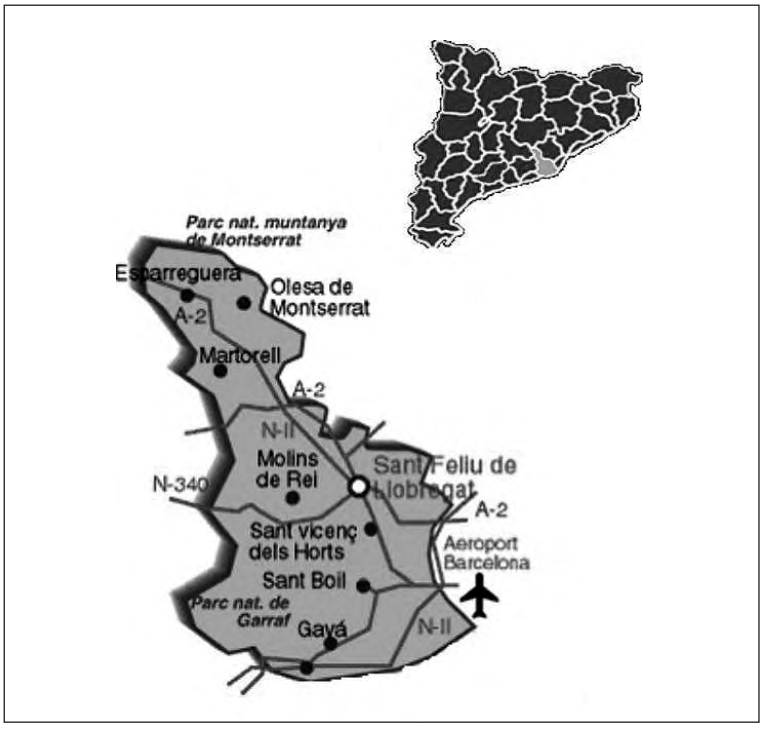
The Universities of Barcelona and Girona and CIDEM will always treat any data and opinions companies may provide in an aggregated way and will under no circumstances publish or diffuse disaggregated data without the authorisation of the company.

5.4. LA CONCA CENTRAL DEL LLOBREGAT. GEOGRAPHICAL BOUNDARIES

For the purposes of this analysis La Conca Central del Llobregat was considered to comprise the region containing the following administrative districts:

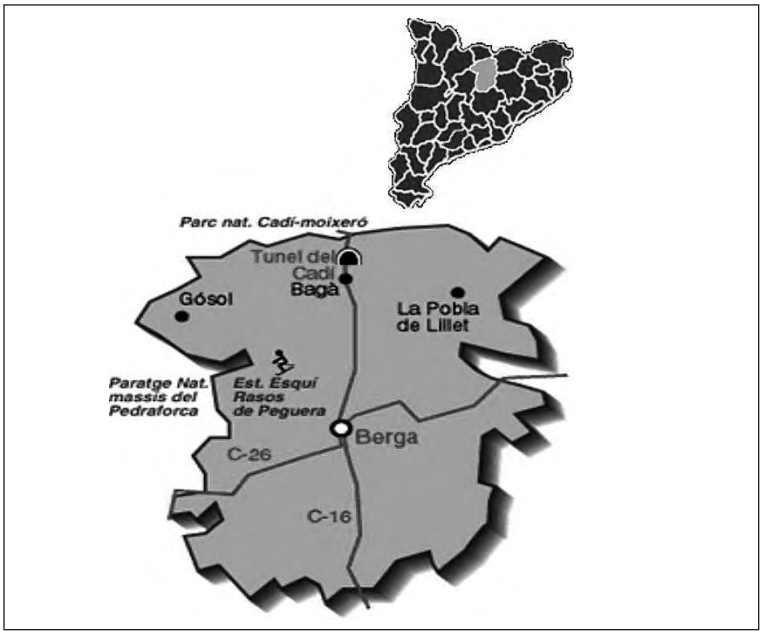
— El Baix Llobregat, from the municipality of Martorell (that is, companies were considered that were located in this municipality or further north)
— The municipalities of Rubí and Terrassa in the administrative district Vallès Occidental and the area of influence between these municipalities and the Llobregat River
— El Bages
— El Berguedà

Baix Llobregat



Bages

Berguedà



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http://www.cidem.com/catalonia/cat/opportunities/foodanddrink/index.jsp Query made to the business opportunity section on the CIDEM website
http://www.idescat.net/cat/economia/ecoserveis.html Website of the Statistics Institute of Catalonia.
http://iri.jrc.es/research/Scoreboards_2006.htm Research for information on «The EU Industrial R&D Investment Scoreboard». This is the central theme on which the study is based. The scoreboard provides rankings of companies' R&D investment, compiled by the European Union.

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