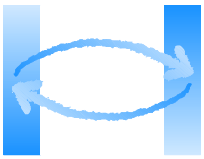
Universität Hannover



Wirtschaftsgeographie

Universität Hannover · Geographisches Institut · Abteilung
Wirtschaftsgeographie
Schneiderberg 50 · D-30167 Hannover

European Regional Science Association

38th European Congress in Vienna, Austria

August 28 – September 1, 1998

Innovation potentials and innovative networks in European metropolitan regions: Some empirical evidence from the Metropolitan Area of Barcelona

Javier Revilla Diez

Department of Economic Geography

University of Hannover, Germany

Phone: 0049-5117623310, Fax: 0049-5117623051

Email: diez@mbox.wigeo.uni-hannover.de

Abstract: In order to make an evaluation of the regional innovation potential, which in our understanding is decisively influenced by the existing relationships between the different actors of innovative networks within and/or outside the region, a written questionnaire was sent to firms of the manufacturing industry in the autumn of 1997. The focal point of the analysis lay in determining innovative activities within individual firms and cooperative relationships between different firms. After a short discussion about theoretical aspects of innovation-orientated regional development this paper provides a brief introduction to the main characteristics of the responding firms as well as selected results concerning innovative activities within the firms, innovative cooperation, as well as obstacles to innovation and regional framework conditions. The results indicate that regional proximity matters differently. Innovative relationships with producer services and research institutions are stronger within the region, those with suppliers, customers and competitors more with other regions in Spain and Europe.

Comments are welcome!

1. Introduction [1]

In recent decades the framework conditions for firms have changed drastically. Global changes, such as the collapse of the socialist planned economies and the resulting appearance of new competitors, the process of industrialisation in the South-East Asian threshold countries, which was successful at least until the Asian crisis, or the emergence of numerous economic areas (EU, NAFTA, APEC, ASEAN, MERCOSUR) are only a few of the developments to which firms must react. The growing evidence of the saturation of numerous markets which brings about the accelerated development of new products and technologies, and the rapidly increasing expenditure on R&D in association with the product life cycles that are becoming shorter and shorter, are just as important. In this connection, the development and the success of new products, processes and organisational solutions depend not only on decisions made within the firms, but also on the national and regional environment: is it possible, for example, to cooperate with suppliers and customers? Or can research, consulting and transfer facilities support innovative processes? For Catalan firms the worldwide change sketched out here is a very special challenge: the firms, which are mostly small family ones, have for decades been directed towards the provision of local, regional and, at most, national markets, and until a few years ago they were protected from foreign competition by high duties and restrictive laws concerning capital invested abroad (Kuntze 1990). It was only with Spain's entry into the EC on January 1st, 1986, that the economic policy, which until then had been aimed at autonomy, was abandoned. Above all, after the European Union came into effect on January 1st, 1993, the firms had to adapt to the new and extremely dynamic framework conditions that were characterised by high competitive intensity (Garcia Echevarria 1989; Bienefeld Boluda 1995). Nevertheless, deficits still continue to exist with regard to the ability of Catalan firms to introduce innovations. The statistics on R&D expenditure show poor results with respect to international standards. The Catalonion ratio of R&D expenditure to Gross Domestic Product (1993) was 1 %, and thus lower than the European average (2 %) (Generalitat de Catalunya 1997). Since the beginning of the Fifties the Catalan government has been trying to strengthen the ability of firms to introduce innovations with the aid of spatially effective instruments that function either implicitly or

[1] The author is deeply indebted to Prof. Escorsa and Jaime Alberto Camacho (Politecnical University of Catalunya) for conducting the postal survey. This research was funded by the German Research Association (GRA) which has also funded two other projects being integrated in a joint approach to analyse the innovative linkages in Vienna (Prof. M. M. Fischer) and Stockholm (Prof. F. Snickars). Within the GRA programm „Technological Change and regional development in Europe“ the Department of Social and Economic Geography in Cologne (Prof. Sternberg), the Economic Policy/Research Unit Innovation Economics at the Technical University Bergakademie Freiberg, Fraunhofer Institute for Systems and Innovation Research in

explicitly. On the one hand, emphasis is laid on the modernisation and consolidation of existing firms, and on the other hand on the support of innovative networks (Generalitat de Catalunya 1995, CIDEM 1996). As is the case in many other countries, evaluations of the strategies, instruments and measures applied do not yet permit any uniform conclusions to be drawn with regard to their regional effectiveness. It is striking that numerous theoretical approaches for explaining regional potentials for innovation actually exist in the scientific discussion, but that there is a lack of empirical verification.

In order to make an evaluation of the regional innovation potential, which in our understanding is decisively influenced by the existing relationships between the different actors of innovative networks within and/or outside the region, a written questionnaire was sent to firms of the manufacturing industry in the autumn of 1997. This received financial support from the DFG (German Research Association). The focal point of the analysis lay in determining innovative activities within individual firms and cooperative relationships between different firms. After a short discussion about theoretical aspects of innovation-orientated regional development this paper provides a brief introduction to the main characteristics of the responding firms as well as selected results concerning innovative activities within the firms, innovative cooperation, as well as obstacles to innovation and regional framework conditions.

2. Theoretical aspects of innovation-orientated regional development

In highly industrialised countries the continued growth of firms, and therefore of regions as well, depends to a great extent on the ability to continuously bring new and innovative products onto the market. Since information and knowledge are the prerequisites for innovation, these two elements become decisive influencing factors in regional development (Nijkamp/Oirschot/Oostermann 1994; Malmberg 1997). The ability to innovate demands access to invisible factors of this kind (tacit knowledge, sticky information) which, for small and medium-sized firms, is only difficult to obtain internally, but which is easier through access to networks. In order to be able to make statements about the regional potential for innovation it is necessary to undertake an analysis of the most important actors, such as firms in manufacturing and producer services, research and development institutions. Only in this way is it possible to determine the cooperative relationships between the interacting partners, and, if necessary, to

---

Karlsruhe and the Department of Economic Geography at Hannover University are investigating innovative potentials and networks in eleven European Regions, using the same methodology.

remove bottlenecks in regional development by intensifying and initiating intra-regional and/or inter-regional networks.

The theoretical base for the evaluation of the regional innovation potential by those cooperative relationships is provided by the theory of the innovative milieu and the network approach that is closely connected with it, and which is complemented by considerations of the transaction cost theory. From the point of view of the innovation milieu, innovations and innovative firms are the result of a collective, dynamic process of different actors within a region, who form a network of synergy-creating cooperative relationships. Interaction between the firms, political decision-makers, institutions and the workforce facilitate learning from one another and together with one another, which helps to reduce uncertainties in technological innovations. According to this theory, it is precisely the small firms that could obtain the greatest advantage from this, thus compensating for disadvantages specific to the firm's size when it is a matter of the ability to carry out innovations. Spatial proximity can support the close cooperation necessary for this (Maskell/Malmberg 1995; Sternberg 1994; Fromhold-Eisebith 1995).

While the milieu approach argues with reference to the region, with the network approach the main interest is directed towards the individual actors. The knowledge networks assume an increasingly decisive role in regional development strategies. This is because innovation networks are the result of the interlinking of information between developers, users and other actors within a knowledge network. Here the participation of firms in knowledge networks depends to a great extent on their absorbtive capacity (Johannson 1991; Karlsson 1994; Nijkamp/Oirschot/Oostermann 1994; Cohen/Levinthal 1990).

The reasons for firms to establish network relationships of this kind are provided by the transaction cost theory. In the innovation process these relationships can make a decisive contribution towards lowering transaction costs, e.g. in the search for partners, joint research and development, and in the diffusion of technical innovation (Fritsch 1992, Herden 1992). In addition to suitable formal framework conditions, informal institutions, such as cultural standards, shape the exchange relationships between the actors, thus explaining the different innovatory ability and economic output of regions and countries (North 1992).

3. Data base, representativeness and response behaviour

The economic activities in Catalonia are strongly concentrated in Barcelona and its industrial belt The selected case study region is seen from a functional perspective. Whereas the research

institutions and producer services tend to be located in Barcelona, industry is found in cities like Granollers, Sabadell, Terrassa, Martorell and Mataro.

In this region a large part of Catalonian industrial production (1993: 25 % of Spanish industrial production), exports (1993: 25 % of Spanish industrial exports), GDP (1993: 19 % of the Spanish GDP) is generated (Generalitat de Catalunya 1995).

The Barcelona Chamber of Commerce provided lists of addresses for the communes of Barcelona, Baix Llobregat, Valles Occidental, Valles Oriental and Maresme according to the following criteria:

- belonging to manufacturing sectors 15 – 36 according to the EU classification of economic activities (NACE)
- registered members
- more than 20 employees.

Table 1: Response Patterns and Representativness of responding manufacturers

	registered firms		responding firms		Representativness ratio
	No.	%	No.	%	%
Industry sector					
Textiles, Clothing, Leather	448	16.9	49	12.4	10.9
Food, beverages, tobacco	83	3.1	13	3.3	15.7
Wood, paper and printing	431	16.3	49	12.4	11.4
Chemicals, rubber, plastics	690	26.0	108	27.4	15.7
Electrical and optical equipment	270	10.2	50	12.7	18.5
Basic metals and metal products	349	13.2	60	15.2	17.2
Machinery, Transport, equipment	379	14.3	65	16.5	17.2
	2651	100	394	100	14.9
Employment size					
≤ 49	1678	63.3	237	60.8	14.8
50 – 99	487	18.4	81	20.8	16.6
100 – 499	416	15.7	55	14.1	13.2
≥ 500	69	2.6	17	4.4	24.6
Total	2650	100	395	100	14.9

Source: Innovation Survey 1997

All the firms fulfilling these selection criteria were written to. Three weeks after the questionnaires had been sent out at the beginning of October the number returned was a disappointing 5 %. Until April 1998 three series of telephone follow-ups were made to the firms that had not replied, thus raising the quota of returned questionnaires to 14.9 %. In fact, when compared with other empirical surveys in Spain this quota must be regarded as a success. For example the EU Community Innovation Survey (CIS) was stopped after two weeks. Only 5.8 % of the firms had replied (Archibugi 1996; Evangelista 1997). A comparison of the distribution by branches in the address data with the responding firms structure shows that no serious deviations occur in any of the branches. The biggest difference is 4.5 percentage points in the textile and clothing industry, which is thus under-represented (cf. Table 1).

A non-response analysis is to provide further indications of the representativeness of the responding firms. With written questionnaires the possibility cannot be excluded that because of the choice of the terminology, such as "innovation" or "research and development", only a certain group participates in the survey, i.e. above all those firms that innovate and carry out research and development (R&D). The lower rate of willingness to reply within the textile and clothing industry could be an indication of a bias towards innovative firms.

4. Main characteristics of responding firms

The composition of Catalan industry shows a considerable degree of diversification, with a greater presence of the textile and clothing, chemical and food sectors. “High-tech” sectors like biotechnology, computers, electronics material, radio and telecommunications and the manufacture of precision instruments show a relatively low performance (Escorsa 1995).

The branch structure of the responding firms is reproduced in Table 2. A differentiation is made between all the responding firms and those that regularly carry out research and development (=innovative firms), and those which do not carry out R&D at all or only seldom (=non-innovative firms). Defined on this basis, only 35 % of the responding firms are non-innovative.

Considering the branch structure it can be noted that the proportion of innovative firms is higher in chemicals, rubber, plastics, electrical and optical equipment, machinery, transport equipment,

and that it lies above the proportion of non-innovative firms. It can therefore be concluded that above-average innovative contributions are to be expected mainly from the branches mentioned.

The average size of the responding firms overall lies at 138 employees per firm, of innovative firms at 200, and of non-innovative firms at 46. While with the last-named group the difference between the mean value and the median is relatively small, the high average figure for the innovative firms is due to a few large firms in the chemical industry and mechanical engineering. The average turnover per firm gives a similar picture. Here, too, the innovative firms lie clearly ahead of non-innovative firms. Once again, there is a great difference between the mean value and the median of innovative firms indicating a few outliers.

One important aspect for determining regional innovation potentials is the degree of external control. Roughly 77 % of the responding firms are single-firm firms without branches, and a further 13 % have their main office in the region. Only 10 % of the firms are subsidiary plants with their head office outside the area covered by the survey. In the case of innovative firms the proportion of main offices and subsidiary plants is distinctly higher, and in the case of non-innovative firms the proportion of single-firm businesses is distinctly higher. This leads one to assume that roughly 30 % of the innovative firms are also more closely integrated into networks outside the region.

As far as their sales are concerned, the responding firms are orientated in varying degrees towards their surrounding regions. The non-innovative firms achieve 64 % of their turnover in the Barcelona region and in the rest of Catalonia, while orientation towards more distant markets is distinctly greater in innovative firms. They achieve 37 % of their sales in the rest of Spain, and roughly 30 % abroad. The member states of the EU are the important export region (cf. Table 3).

The qualification structure of the responding firms also provides initial indications about the internal ability to innovate. The proportion of highly qualified employees lies at an average of 7 % university graduates per firm. While 8 % of the employees within innovative firms are university graduates, the non-innovative firms have only 5.2 %.

Table 2: Selected characteristics of manufacturing sample firms

	sample firms All		sample firms with regular R&D		sample firms with no regular R&D	
	number	%	number	%	number	%
Industry sector						
Textiles, Clothing, Leather	49	12.4	27	11.6	18	14.6
Food, beverages, tobacco	13	3.3	6	2.6	7	5.7
Wood, paper and printing	49	12.4	22	9.5	23	18.7
Chemicals, rubber, plastics	108	27.4	72	31.0	27	22.0
Electrical and optical equipment	50	12.7	34	14.7	10	8.1
Basic metals and metal products	60	15.2	32	13.8	20	16.3
Machinery, Transport, equipment	65	16.5	39	16.8	18	14.6
	394	100	233	100	123	100
Location						
Capital region	139	35.3	87	37.5	41	33.3
Hinterland	255	64.7	145	62.5	82	66.7
Total	394	100	232	100	123	100
Corporate Status						
Single establishment	299	77.3	164	71.3	105	87.5
Multi-establishment organisation						
Main plant	50	12.9	39	17.0	9	7.5
Branch plant	38	9.8	27	11.7	6	5.0
Total	389	100	230	100	123	100
Employment size						
≤ 49	237	60.8	116	50.4	95	78.5
50 – 99	81	20.8	55	23.9	17	14.0
100 – 499	55	14.1	42	18.0	9	7.4
≥ 500	17	4.4	17	7.3	0	0.0
Total	390	100	230	100	123	100
R&D expenditure [a]						
None	57	17.2	0	0.0	49	45.0
0,1 – 3,9	145	43.8	93	45.8	45	41.3
4 – 7,9	63	19.0	50	24.6	10	9.2
≥ 8	66	19.9	60	29.6	5	4.6
Total	331	100	203	100	109	100

note a: average of last three years Source: Innovation Survey 1997

Table 3: Market Reach of Surveyed Firms

	Firms with Continious on-site R&D	No continous R&D	All firms
	%	%	%
Metropolitan Region	25	50	33
Rest of Catalonia	11	14	13
Rest of Spain	37	27	33
European Union	17	6	15
USA	2	0	1
Latin America	4	2	3
Rest of World	4	1	4
	100	100	100

Source: Innovation Survey 1997

5. Internal innovation activities

The high proportion of firms that carry out research and development within the region corresponds to the large proportion of autonomous decision making competence of the responding firms within the region: almost 80 % of the R&D activities of the firms take place in and around Barcelona.

What is meant by "innovative activities within firms" is the substantial improvement of an existing product or the manufacture of a new product for the firm (product innovation) and an essentially improved or new production process (process innovation) (OECD 1994, p.19 ff.). According to this definition, 72 % of the responding firms carried out innovative projects between 1994 and 1997.

Depending on which phase in the innovation process is being described, a distinction is made between input, throughput and output indicators. Input indicators, such as employees in R&D, the level of expenditure on R&D and the continuity of R&D activities, permit initial conclusions to be drawn concerning the innovative potentials. As already discussed in Section 3 under the general characteristics of the responding firms, when the proportion of employees in R&D is compared with the total number of employees, the R&D intensity is 7 %. The chemical and electrotechnical industries, as well as mechanical engineering, are marked by strong above-average R&D activities. As expected, the proportions of the textile and clothing industry, the food industry and wood processing lie distinctly below the average. When referred to the

turnover, the average expenditure on R&D is 4.2 %. There are considerable differences between the different branches of industry. In contrast to the proportion of employees in R&D, the food, textile and clothing firms lie clearly above the average of the firms questioned, while the chemical industry, the electrotechnical industry and mechanical engineering have values between 3.8 and 4.2 % in accordance with the average. It would be too simple to conclude from this result that R&D activities have a lower status in the latter branches of industry. It is a fact that R&D quotas referred to the turnover are meaningful only to a limited extent. In the course of new production concepts the production depth in firms is reduced, while, in contrast, the proportion of components produced outside the firm and of services in the turnover has increased. This raises the turnover without any associated expenditure on innovations. The indicator expenditure on R&D as percentage of the gross profit provides a more accurate picture of the expenditure actually required for product and process innovation. For mechanical engineering this proportion is calculated as being at least 75 %.

Different activities regarding type and continuity are hidden behind the term research and development. In Barcelona, development, i.e. the use of already existing scientific and technical knowledge to obtain new and fundamentally improved materials, products/services or processes, has a far greater status than research within the firm (obtaining new scientific and technical knowledge). 55 % of all firms carry out permanent development, while permanent research is carried out by only 37 %. The proportion of firms that achieve neither production nor process innovations, but which nevertheless carry out research and/or development at least occasionally, is negligible. This means that the firms carrying out R&D translate their activities into product and/or process innovations (cf. Table 4).

In contrast to the input indicators, patents are the result of actual invention achievements. They are at the end of the invention process and have not yet been translated into a marketable products. 23.8 % of the firms have applied for a patent for at least one invention. The average number of patented inventions is 10.7. The tendency to apply for patents varies greatly between the different branches of industry. It can clearly be seen that not all the inventions of the chemical and electrical industries, or of mechanical engineering, were patented. This was due to reasons of cost and procedures. The low values cannot be explained in any other way. When referred to the size of the firm, small and medium-sized firms are more active than large firms with regard to patents.

Table 4: Innovation activities (1994 –1996) by industry

	Industrial sector							
	Textiles, Clothing, Leather	Food, beverages, tobacco	Wood, paper and printing	Chemicals, rubber, plastics	Electrical and optical equipment	Basic metals and metal products	Machinery, Transport, equipment	Total
Resources devoted[a]								
R&D expenditures for product innovation(∅ Mio. Ptas)	67.8	428.6	14.1	81.5	37.5	19.3	510.0	142.0
R&D expenditures for process innovation (∅ Mio. Ptas)	35.1	430.3	7.3	48.4	27.2	27.2	20.1	49.0
R&D personel intensity (in % of total employees)	6.4	4.4	5.5	7.7	7.6	7.0	7.5	7.0
Outcome of innovation activities[a]								
Patented inventions (per 100 employees)	10.9	0.1	26.2	1.3	3.1	2.0	2.3	5.9
New products (per 100 employees)	15.3	15.4	39.1	29.3	29.4	21.6	8.1	22.9
Turnover of new products (∅ Mio. Ptas)	730.2	674.3	430.9	533.2	327.6	154.2	6236.8	1447.9
Improved products (per 100 employees)	84.9	9.9	27.8	18.1	26.0	35.2	17.2	31.9

note a: average of last three years

Source: Innovation Survey 1997

Of the innovative firms in Barcelona 15.4 % restrict themselves exclusively to product innovations, and 14.7 % exclusively to process innovations. Roughly 70 % of the firms change both products and processes, and here the close interconnection between product changes and the change in production processes is underlined. Of the firms with product innovations 58 % have undertaken product differentiation, while the remaining 42 % have introduced completely new developments. The responding firms stated that the essential precondition for the realisation of product innovations is experience gained from their own production of similar products or from previous products. 80 % considered this precondition to be very important. Their own R&D (77 %) followed in second place, so that existing know-how together with their own research and development work represent the most important bases for product development. Other important preconditions are market analysis (85.2 %), the training of employees (45 %) and parallel process innovations (47 %). Acquisition of licenses (6.1 %) and cooperation with other firms and/or research institutions (24 %) only play a subordinate role. Process innovations are furthered by the firms' own research or development work (71 %), by training employees (53.5 %), acquisition of licences and technological manufacturing components (41 %). Changing the internal work organisation as well as cooperation with other firms are relatively unimportant (30 % each).

Above all, the customers (85 %), information from attending trade fairs and exhibitions (69 %), and direct competitors are important sources of information concerning product innovations. In contrast, the importance of suppliers in process innovations is clear. 62 % of the firms with process innovation obtain their information direct from suppliers. Information from visits to trade fairs and exhibitions is also very important (58 %).

Table 5: Sources of external information for product and process innovation

Sources	Product innovation activities		Process innovation activities	
	no.	%[a]	no.	%[b]
Customers	240	84,5	72	28,2
Suppliers/subcontractors	124	43,5	159	62,4
Competitors	155	54,4	66	25,9
Universities/Research Institutions	57	20,0	54	21,2
Producer services	77	27,0	108	42,4
Fairs/Exhibitions	197	69,1	150	58,8
Scientific Publications	110	38,6	101	39,6
Media	53	18,6	39	15,3
Internet	26	9,1	12	4,7
N =	285		255	

note a: percentage of all firms with product innovations
note b: percentage of all firms with process innovations

Source: Innovation Survey 1997

The proportion of products newly introduced or considerably further developed between 1994 and 1997 as a percentage of the actual turnover is an indicator for the novelty of the production structure and for the market success of innovation projects. Depending on the branch involved, the percentages have a wide range. In the food industry, wood processing and chemical industries new products only make a small contribution to the turnover, while in mechanical engineering and vehicle production they contribute an average of 37 %, in the electrical industry 33 %, and in the textile and clothing industry 35 %. Large differences between the mean and the median occur only in mechanical engineering and vehicle construction, as well as in the textile and clothing industry. This means that within these sectors the discrepancy between firms with particularly new types of products and primarily "old" products is relatively large.

6. External innovation relationsships

With the increasing concentration of firms on core competences, the cooperation between different actors becomes increasingly important in the realisation of innovation projects.

First of all, it must be stated that more firms which regularly carry out R&D with other partners (customers, suppliers, producer services, competitors and research institutions) work together beyond normal business relations than is the case with firms that seldom or never carry out R&D.

Where cooperation takes place, it is predominantly with customers (69 % of all firms mentioned cooperation of this kind) and with producer services (69 %), followed by cooperation with suppliers (59 %), research institutions (25 %) and competitors (24 %). The regional distribution of the cooperation partners as well as the intensity of the cooperation between innovative firms permit initial conclusions to be drawn concerning the range of cooperation relations and the spatial search range. While cooperation with the customers is very intensive with partners in the whole of Spain, with suppliers the very intensive cooperation is concentrated on the Barcelona region and the rest of Catalonia (totalling 57 %). In contrast to the situation with the customers, for the suppliers innovation partners from the EU play a more important role. As far as cooperation with competitors is concerned, the immediate vicinity predominates (24 % Barcelona region, 17 % rest of Catalonia), followed by innovation partners from the EU (21 %). Regional cooperation predominates in the service sector. 68 % of all the contacts are referred to

producer services in the proximity of the firms in Barcelona and in the rest of Catalonia. In the case of innovation cooperation with research institutions, only 6 % of the partner institutes are from non-European countries. As in the case of the producer services, cooperation takes place predominantly with institutions from the closer vicinity. 45 % of the partner institutes are based in the region, 12 % in the rest of Catalonia, and 22 % in the rest of Spain. It must be assumed that the spatial proximity between industrial firms and research institutions facilitates the handling of complex research and cooperation contents. Here it is less the risk of losing competence that stands in the foreground, but rather problems of understanding that can foster the manageability of new knowledge due to the spatial proximity (the possibility of face-to-face contacts). These are aspects that can also explain the great significance of spatial proximity for cooperation between industrial firms and producer services which, in addition to customers and suppliers, express the greatest absolute number of cooperative relationships (cf. Table 6).

In order to get a more detailed insight into the innovative cooperation relationships the firms were asked in which phase of the innovation process and with which intensity they collaborate with customers, suppliers, producer services, competitors and research institutions. In general, the cooperation is stronger in the early stages of the innovation process, but significant differences are distinguishable between the cooperation partners. The most balanced cooperative relationships occur with customers. Besides intensive cooperation in early stages like the general exchange of information, the generation of new ideas and conception/front-end development, the responding firms collaborate intensively in prototype development, pilot application and market introduction with their customers. The regional scope of these relationships is more diverse than with other innovation partners. Partners outside the case study region, especially in the rest of Spain and the EU, are predominant through all the innovation stages. Cooperation with suppliers is more concentrated in the early stages, comparable to the cooperation with producer services. Their regional patterns differ considerably. Both actors have strong relationships within the region, but cooperation with suppliers is more orientated to the EU countries than the cooperation with producer services. Although in absolute figures less important than the cooperation with the already mentioned innovation partners, cooperation with competitors and research institutions include general exchange of information and the more confidential prototype development. Interestingly, the relationship with competitors in the field of prototype development is strongest in the EU, while the mentioned relationships with research institutions are concentrated in the Metropolitan Area of Barcelona or the rest of Spain.

Table 6: Network relationship with research institutions, suppliers, producer services, customers and other firms

	Research Institutions				Suppliers				Producer services				Customers				Other firms			
	Strong		weak		strong		weak		strong		weak		strong		weak		strong		weak	
	no.	%[a]	no.	%[a]	no.	%[a]	no.	%[a]	no.	%[a]	no.	%[a]	no.	%[a]	no.	%[a]	no.	%[a]	no.	%[a]
Pre-competitive stage																				
Information exchange	46	61.3	22	43.1	132	76.3	50	34.0	126	68.1	67	41.9	162	77.9	46	28.6	48	70.6	17	37.0
Identification of new ideas	34	45.3	28	54.9	114	65.9	57	38.8	103	55.7	81	50.6	138	66.3	70	43.5	43	63.2	19	41.3
R&D	45	60.0	20	39.2	80	46.2	81	55.1	98	53.0	83	51.9	100	48.1	80	49.7	31	45.6	26	56.5
Competitive stage																				
Prototype development	37	49.3	28	54.2	97	56.1	75	51.0	81	43.8	96	60.0	123	59.1	73	45.3	31	45.6	24	52.2
Pilot projects	26	34.7	35	68.6	66	38.2	90	61.2	66	35.7	102	63.8	117	56.3	71	44.1	24	35.3	30	65.2
Marketing	6	8.0	47	92.6	36	20.8	115	78.2	44	23.7	123	76.9	110	52.9	88	54.1	20	29.4	34	73.9
N =	75		51		173		147		185		160		208		161		68		46	

note a: percentage figures as column %

Source: Innovation Survey 1997

The motives for entering into innovation cooperations vary depending on the actor. While in the case of cooperation with research institutions it was, above all, the opportunity to enter new technological fields (68 % of the firms questioned that cooperate with research institutions) and the know-how takeover (48 %) that were most important, in the case of cooperation with competitors it was risk reduction that was given as the most important motive. As far as cooperation with producer services is concerned, it is not possible to detect any clear picture. While risk reduction, entering new technological fields, financial resources and acquisition of funds are of relatively equal importance for entering into cooperation with producer services, the know-how-takeover is relatively unimportant (cf. Table 7).

Table 7: Motives for exercising network activities

	Research Institution – Industry relations		Producer services – Industry relations		Interfirm relations[b]	
	no.	%[a]	no.	%[a]	no.	%[a]
Share the risks	15	17.2	55	35.0	97	66.4
New technological opportunities	59	67.8	60	38.2	60	41.1
Knowledge transfer	42	48.2	39	24.9	43	29.5
Financial resources	3	3.4	56	35.6	9	6.2
Funding requirements	15	17.2	61	38.9	3	2.1
n=	87		157		146	

note a: percentage of all firms with such relations Source: Innovation Survey 1997
note b: suppliers, customers, competitors

When they are questioned about the problems of innovation cooperation, the firms give different answers depending on the cooperation partner. While coordination difficulties in cooperation with research institutions (48 % of the firms mentioned problems with research institutions) are seen as the most important problem, with the producer services it is the budgeted cost overrun (48 %). The lack of schedule effectiveness is seen as the greatest problem in cooperation with other industrial firms (cf. Table 8).

Table 8:Problems with exercising network activities

	Research Institution – Industry relations		Producer services – Industry relations		Interfirm relations	
	no.	%[a]	no.	%[a]	no.	%[a]
Problems with project leadership	8	16.0	25	23.6	21	17.1
Budgeted cost overrun	13	26.0	51	48.1	37	30.1
Unintentional knowledge drain	5	10.0	7	6.6	10	8.1
Coordination difficult	24	48.0	33	31.1	46	37.4
Different capability	15	30.0	25	23.6	31	25.2
Confidential relation/secrecy	2	4.0	5	4.7	12	9.8
Loss of independance	3	6.0	6	5.7	19	13.0
Lack of schedule effectiveness	15	30.0	32	30.0	91	74.0
N=	50		106		123	

note a: percentage of all firms with such relations (column %)

Source: Innovation Survey 1997

In an evaluation of regional framework conditions for innovative activities, the responding firms were able to assess individual factors both as being bad and good. This means that the individual aspects that, in their entirety, determine the regional framework conditions for innovation can be judged positivly and negativly. The quality of the transportation infrastructure was mentioned by the innovating firms as being the most positive factor. The availability of suitable staff, the research capacity, and the consultancy offers, as well as the availability of suppliers and customers were given more positive than negative mentions. State bureaucracy, the offer of equity capital and the technology/economic policy were considered to be negative by the majority of all the firms. This negative assessment indicates that the regional support programmes by the central government, the state or the EU are of little importance (cf. Table 9).

Table 9: Assessment of general locational factors for firms‘ innovation activities

Locational factors	Poor[a]		Good[a]	
	No.	%	No.	%
Supply of capital	155	65.2	92	32.0
Availability of qualified labour:				
- in scientific-technical sector	50	30.3	182	63.2
- in business sector	31	21.0	157	54.5
Research capacity	45	18.9	140	48.6
Availability of consulting services	45	18.9	148	51.4
Willigness to cooperate				
- with other firms	58	24.4	108	37.5
- with research institutions	52	21.8	111	38.5
Local technology/economic policy	67	28.2	63	21.9
General climate for innovation	56	23.5	104	36.1
Availability of suitable clients	39	16.4	129	44.8
Availability of suitable suppliers	37	15.5	164	56.9
State bureaucracy	180	75.6	13	4.5
Telecommunication links	22	9.2	155	53.8
Quality of transportation infrastructure	16	6.7	205	71.2

note a: percentage of all firms Source: Innovation Survey 1997

7. Summary

The object of this overview was to present the initial results of the innovation survey in Catalonia. The most important results so far can be summarized as follows:

- Firms regularly carrying out R&D bring more new products onto the market, achieve higher average rates of turnover and make a greater contribution towards guaranteeing employment than is the case with firms that seldom or never carry out R&D.

- Vertical cooperation with suppliers and customers plays a distinctly more important role in innovation cooperation than horizontal partnerships with research institutions and

competitors. The producer services, which tend to be technically orientated, make a contribution towards vertical cooperation. Those which tend to be more business consulting orientated make a greater contribution towards horizontal cooperation.

- The regional range of innovation cooperation is restricted primarily to Spain. Only the suppliers have intensive partnerships in countries of the EU.

- While the regional framework conditions for innovations are seen generally as being positive, the verdict on government support for industry and for technology is very negative.

At this point in time it is too early to undertake further interpretations of the results. This requires additional analyses and interpretations of the results, which are possible with the data set.

References

Archibugi et. al. 1997: Evaluation of the Community Innovation Survey. In: Arundel/Garrelfs: Innovation Measurement and policies. Luxembourg.

Backhaus/Seidel 1997: Innovationen und Kooperationsbeziehungen von Industriebetrieben, Forschungseinrichtungen und unternehmensnahen Dienstleistern – die Region Hannover – Braunschweig – Göttingen im interregionen Vergleich. In: Hannover working papers in Economic Geography, No. 19.

Bienefeld Boluda, J. 1995: Wettbewerbsfähigkeit und Internationalisierungseffekte am Beispiel katalanischer Industrieunternehmungen. Göttingen.

Caixa de Catalunya 1995: Anuari Economic Comarcal1995. Barcelona.

Camagni, R. (Hrsg.) 1991: Innovation Networks: Spatial Perspectives. London, New York.

Caravaca Barroso; Sanchez Lechuga 1995: Cambios socioeconomicos, desempleo y desequilibrios territoriales en España. In: Estudios Regionales No. 42. p. 15-52.

CIDEM 1996: Informacion General. Barcelona.

Cohen, W./Levinthal, D.A. 1990: Absorptive Capacity: A New Perspective on Learning and Innovation. In: Administrative Science Quarterly, Vol. 35. p.128-152.

Escorsa, P. 1995: The management of research and technology: the case of Catalonia. Paper presented at the R&D Management Conference „Knowledge, Technology and Innovative Organisations“ in S. Miniato, 20-22 September 1995.

Evangelista et. al. 1997: Innovation Expenditures in European Industry. EIMS Publication No. 48.

Fritsch, M. 1992: Unternehmens-"Netzwerke" im Lichte der Institutionenökonomik. In: Jahrbuch für Neue Politische Ökonomie, Bd.11. p.89-102.

Fromhold-Eisebith, M. 1995: Das "kreative Milieu" als Motor regionalwirtschaftlicher Entwicklung. Forschungstrends und Erfassungsmöglichkeiten. In: Geographische Zeitschrift, Jg. 83, H. 1, p. 30-47

Garcia Echevarria 1989: El reto empresarial español - la empresa española y su competividad. Madrid.

Generalitat de Catalunya (Hrsg.) 1995: Anuario estadistico 1995. Barcelona.

Generalitat de Catalunya (Hrsg.) 1997: II Pla de Recerca de Catalunya 1997/2000. Barcelona.

Grotz, R. /Braun, B. 1993: Networks, Milieux and Individual Firm Strategies: Empirical Evidence of an Innovative SME Environment. In: Geografiska Annaler Vol. 75B (3), p.149-162.

Herden, R. 1992: Technologieorientierte Außenbeziehungen im betrieblichen Innovationsmanagement: Ergebnisse einer empirischen Untersuchung. Heidelberg.

Johansson, B. 1991: Economic Networks and Self-Organization. In: Bergman, E.M./Maier, G. /Tödtling, F. (Hrsg.): Regions Reconsidered - Economic Networks, Innovation, and Local Development in Industrialized Countries. London. p. 17-34.

Johansson, B./Karlsson, C. /Westin, L. (Hrsg.) 1994: Patterns of a Network Economy. Berlin.

Karlsson, C. 1994: From Knowledge and Technology Networks to Network Technology. In: Johansson, B./ Karlsson, C. /Westin, L. (Hrsg.): Patterns of a Network Economy. Berlin. p. 207-228.

Kogut, B./Shan, W. /Walker, G. 1993: Knowledge in the Network and the Network as Knowledge: The Structuring of New Industries. In: Grabher, G. (Hrsg.): The Embedded Firm - on the Socioeconomics of Industrial Networks. London, New York.

Kuntze, O.E. 1990: Vorbereitung zehn westeuropäischer Industrieländer auf den EG-Binnenmarkt 1993. (IFO-Studien zur europäischen Wirtschaft Nr.1). München.

Malmberg, A. 1997 : Industrial geography. Location and Learning. In: Progress in Human Geography. Vol. 21. No. 4. p. 573-582.

Maskell, P./ Malmberg, A. 1995: Localised Learning and Industrial Competitiveness. Paper presented at the Regional Studies Association European Conference on "Regional Futures: Past and Present, East and West". May 1996, Gothenburg.

Nijkamp, P./Oirschot, G. van /Oosterman, A. 1994: Knowledge Networks, Science Parks and Regional Development: An International Comparative Analysis of Critical Success Factors. In: Cuadrado-Roura, J.R./Nijkamp, P. /Salva, P. (Hrsg.): Moving Frontiers: Economic Restructuring, Regional Development and Emerging Networks. Aldershot. p. 225-246.

North, D.C. 1992: Institutionen, institutioneller Wandel und Wirtschaftsleistung. Tübingen.

Schätzl, L. 1996: Wirtschaftsgeographie 1 – Theorie. 6. Auflage. Paderborn.

Sternberg, R. 1995: Technologiepolitik und High-Tech Regionen - ein internationaler Vergleich. Münster, Hamburg. (Wirtschaftsgeographie, Bd. 7).