

Summary Report of the Focus Group on Innovative Firm Networks

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1. Introduction: Rationale of the work in a NIS framework

Despite an increasing awareness of (and agreement upon) the importance of inter-firm linkages and linkages between firms and knowledge institutions in connection with product innovation, few attempts have been made to systematically collect empirical data mapping such relationships enabling cross-country comparisons. So far, comparative data have been mainly case study based. This has been a main impetus for the initiative of data gathering in connection with the OECD-theme on inter-firm collaboration¹.

¹ More recent comprehensive approaches to survey the collaboration of innovative firms include the CIS- (Community Innovation Survey) and the PACE-survey (Policies, Appropriability and

In the past 10-15 years there has been considerable developments in the perception of innovation processes. Today, there seems to be little disagreement with the fact that technological innovation proceeds as a complex interaction between research, design, production and marketing and takes place in a seamless web of interactive learning between a variety of actors at all levels in the economy (Lundvall, 1992); multiple sources of information and pluralistic patterns of collaboration seem to be the rule rather than the exception.

If innovation was pursued by atomistic agents acting in isolation there would be little reason to look for 'systems' of innovation. The concept of a 'system of innovation' is therefore deeply rooted in the belief that innovation is an interactive process where agents and organisations communicate, cooperate and establish long term relationships. Much of the recent literature on innovation systems (Nelson, 1993 and Lundvall, 1992) stress the fact that *national* (regional) specificities of patterns of interaction between users and producers of innovations are at the very core of what defines a national (regional) innovation system (Freeman, 1987; 1995, Lundvall, 1988; 1992, Nelson, 1993 and Edquist, 1997). Being important constitutive elements of national systems of innovation, these patterns of interaction are regulated by institutions in terms of rules, norms and habits. The crucial relationships in a national system of innovation are reflected in structures discernible in production and trade specialisation patterns. However, it has to be kept in mind that the national system of innovation is an *open* system. Increasingly, interaction in connection with innovation can be expected to take place *across* national borders.

Following these lines of argumentation, a considerable variation between national innovation systems in terms of the extent to which firms interact with different collaboration partners and in terms of whether collaboration is pursued with domestic or international partners can be expected. Investigating patterns of inter-firm collaboration, in terms of "with whom, how and why do which firms collaborate", is useful in order to highlight these differences between national innovation systems and is also a fruitful way of examining to which extent innovation systems are national or international.

The issue is relevant not only because of the pertinent role of inter-firm collaboration in innovation systems. There are trends in the economy related to internationalisation, new technology and new modes of knowledge production which make such a study more important than ever.

In spite of obvious inherent potentials in applying such a perspective, the analysis of national (regional) systems has not pursued systematic international comparisons in these respects. There is a void with regard to systematic empirical investigations using truly comparative data when it comes to explore the interaction of firms with regard to product innovation. One of the main objectives of the EuroDISKO survey is to generate such internationally comparative data on collaboration on product innovation, in order to increase our understanding of this dimension of innovation systems.

Competitiveness for European Enterprises). Work in the focus group has included use of existing surveys as well as the new data collection. In this report we focus upon results from the latter. Results from the other surveys may be obtained from Christensen & Rogaczewska, 1998, where CIS/CIS-like types of data are used to explain inter-firm collaboration in Switzerland, Germany and Spain.

2. Methodology and Findings

2.1. Methodology

The Focus Group has seen it as one of its most prominent tasks to ensure comparability across the participating countries by agreeing upon a common approach and a set of guidelines for empirical work. As a first proxy for harmonising the method for collecting empirical data on patterns of inter-firm collaboration in product innovation, most of the participating countries have agreed upon using CATI (Computer Aided Telephone Interviewing) and the research design of the Danish DISKO (Danish Innovation System in a Comparative Perspective) project².

Besides the agreement upon using CATI, a set of common questions to be used as a reference point for the participating countries has been formulated. Main categories of questions refer to:

- * type of partner
- * reason for and importance of collaboration with the specific type of partner
- * duration and intensity of collaboration
- * mobility of labour during collaboration
- * services related to product development

There are at least two major differences with regard to the data generated within this project and the data obtained from the CIS-surveys. *First*, the focal point with regard to collaboration in EuroDISKO is on innovation and not on R&D as in CIS³. *Second*, in CIS the focus on the use of external information sources primarily concerns the spark to the innovation process, whereas the EuroDISKO survey opens up the possibility for revealing with whom firms collaborate in carrying through the innovation process.

This summary mainly deals with types of partners which are involved in the development of new or improved *physical* products.

2.2 Firms rarely innovate alone

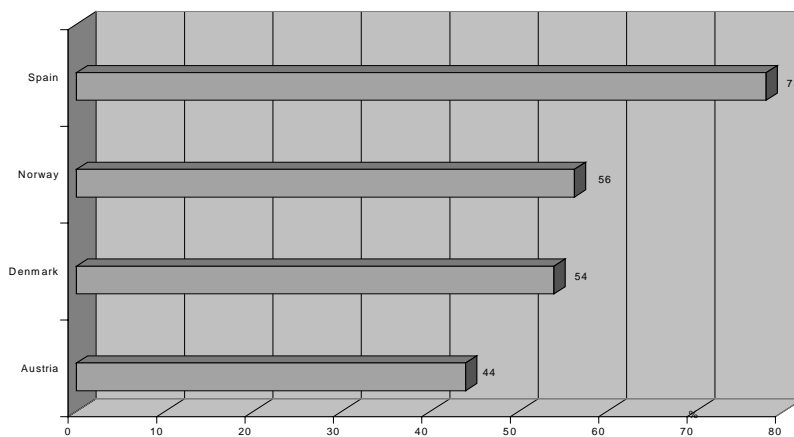
The CIS-surveys as well as the EuroDISKO survey carried out in Austria, Denmark, Norway and

² In the remainders of this report we will refer to this common research approach as EuroDISKO

³ A second CIS survey, building on the methodological and analytical lessons learned in the first phase (1991-1993) was launched in 1997. Here, the question on R&D collaboration has been replaced with a question on innovation and collaboration.

Spain bear evidence to the fact that *firms rarely innovate alone*. As depicted in figure 1 and figure 2, in Austria 44% of the firms in the sample had developed one or more new products within the last two years of which 62% involved collaboration with one or more partners. In Norway 56% of the firms indicated having developed one or more new products of which 75% indicated collaboration. In Spain 78% of the firms had developed one or more new products within the past three years of which 83% collaborated with one or more partners while in Denmark, of the 54% that indicated having developed one or more new products within the last two years the proportion indicating collaboration was as high as 97%⁴.

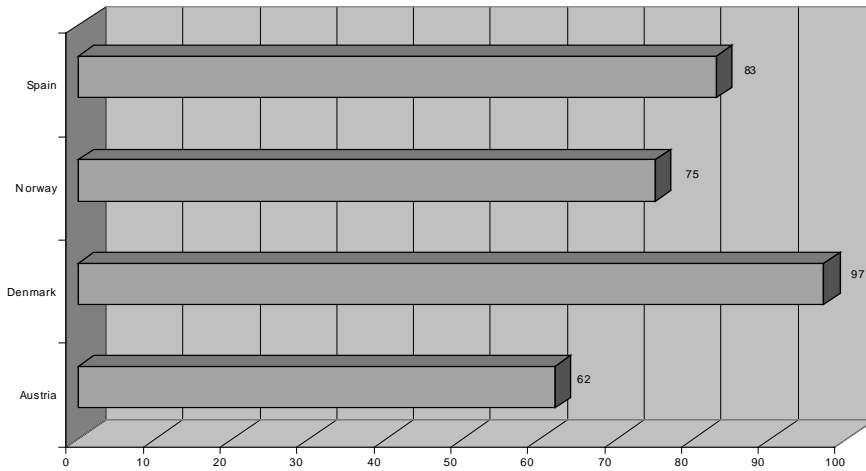
Figure 1: Product Innovation: Austria, Denmark, Norway and Spain, 1997.



Source: Sanz-Menéndez et al. (1998), Schibany, A. (1998), Ørstavik and Nås (1998) and the DISKO-survey (1998)

Figure 2: Product Innovation and Collaboration: Austria, Denmark, Norway and Spain, 1997

⁴ In Austria the sample size amounts to 1006 firms, in Denmark 1022 firms, in Norway 797 firms and in Spain 398 firms.

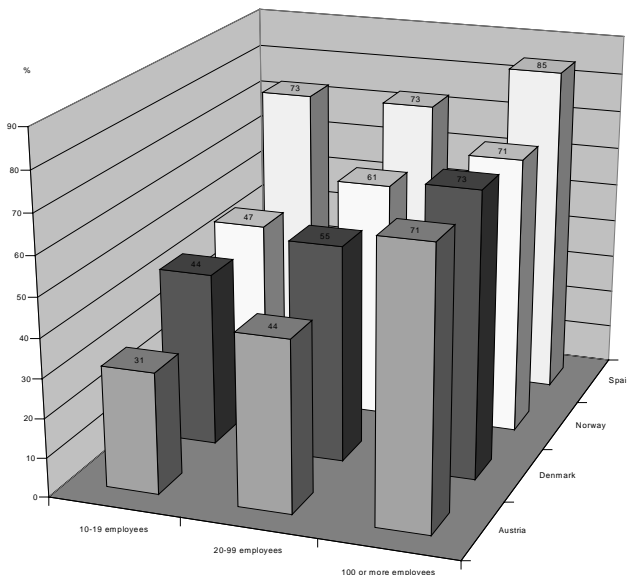


Source: Sanz-Menéndez et al. (1998), Schibany, A. (1998), Ørstavik and Nås (1998) and the DISKO-survey (1998)

2.3 Product innovation and firm size

The surveys enable us to compare the four countries in terms of whether product innovation is positively correlated with firm size. In all countries the data bear evidence to the fact that *there seems to be a positive correlation between firm size and product innovation.*

Figure 3: Product Innovation and Firm Size: Austria, Denmark, Norway and Spain, 1997.



Source: Sanz-Menéndez et al. (1998), Schibany, A. (1998), Ørstavik and Nås (1998) and the DISKO-survey (1998)

As depicted in figure 3 in Austria 31% of small firms with 10-19 employees have developed a new product within the past two years. For firms with 100 and more employees the percentage increases

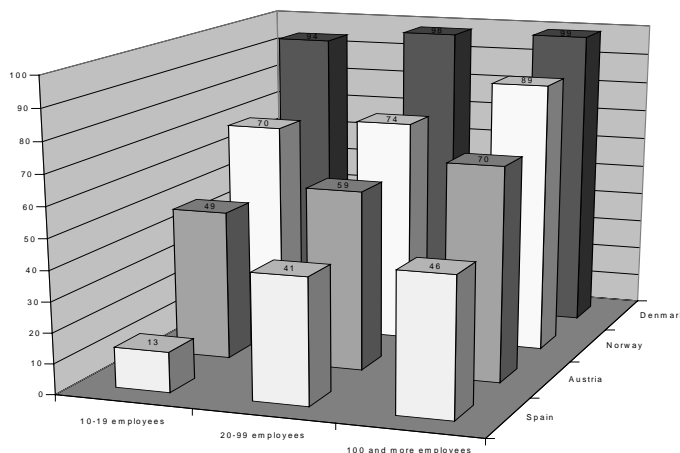
significantly amounting to 70% (in Austrian firms with 500 and more employees the proportion amounts to 80%). In Denmark the same tendency is discernible. Within the group of small firms with 10-19 employees 44% had developed a new product within the past two years. The percentage also increases significantly with firm size. Among Danish firms with 100 and more employees, 72% had developed a new product within the past two years (in Danish firms with 200 and more employees the proportion amounts to 82%). In Norway 47% of small firms have indicated having developed one or more new products within the past two years whereas the percentage increases to 71% for firms with 100 employees and more. In Spain the dispersion between the smallest and the largest firm size class is not that big. Nevertheless, a positive correlation between innovation and firm size can still be discerned. In firms with 10-19 employees 73% had developed a new product within the past three years, whereas the proportion amounts to 85% for firms with 100 and more employees.

The positive correlation between firm size and innovation is not surprising. The CIS has shown similar results⁵ and it is more likely that a large firm with a bigger variety of products and more resources would have made changes to at least one of the products within the past two (in the case of Spain: three) years.

2.4. Collaboration and firm size

There is a general tendency for collaborative behaviour to rise with firm size.

Figure 4: Collaboration and Firm Size: Austria, Denmark, Norway and Spain, 1997.



Source: Sanz-Menéndez et al. (1998), Schibany, A. (1998), Ørstavik and Nås (1998) and the DISKO-survey (1998)

As shown in figure 4 at a general level the propensity to collaborate rises with firm size. In Austria the tendency is most clear: Whereas 49% of small product innovating firms (10-19 employees) have

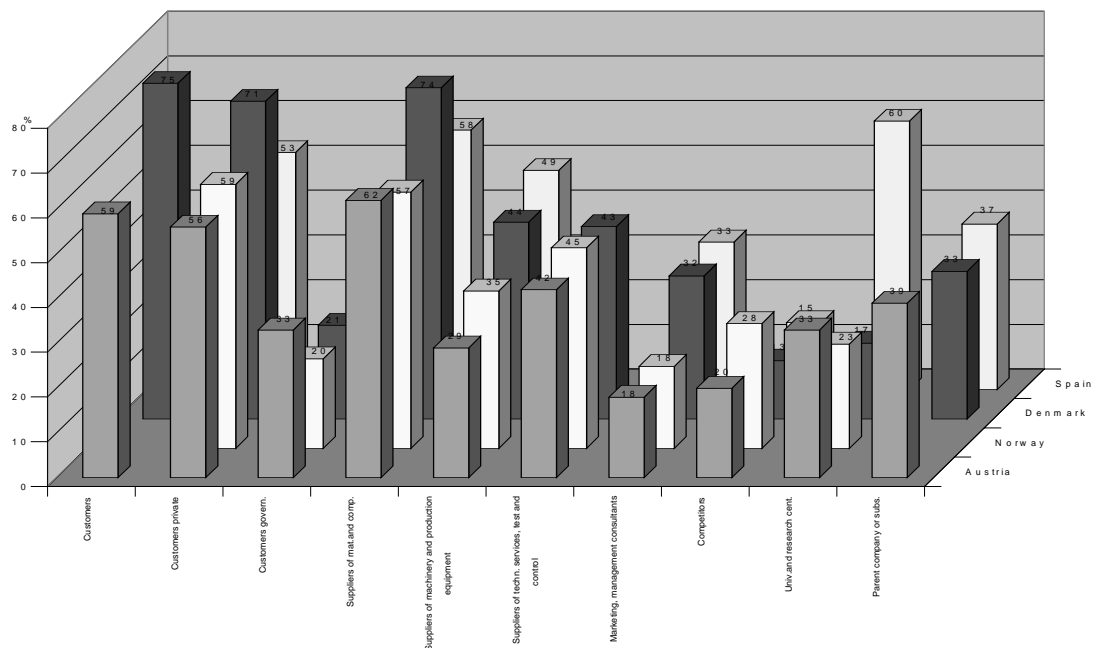
⁵ A related issue is whether large firms innovate more than small firms do. CIS and CIS-like studies generally did not point to any differences with regard to innovation intensities across firm size.

collaborative arrangements the percentage increases to 70% for large product innovating firms. In Denmark a surprisingly high percentage of small firms (94%) indicate collaboration and close to all large product innovating firms in the sample (99 %) have collaborated. In Norway 70% of small firms indicate collaboration increasing to 89% for firms with 100 employees and more. The Spanish results are somewhat intriguing. Only a limited number of small firms indicate having had collaboration (13%). The percentage increases significantly to 41% for firms with 20-99 employees, but hardly increases for firms with 100 and more employees. As will be shown later, in the case of Spain there is hardly any correlation between firm size and collaboration when split up according to collaboration partners except for collaboration with parent company or subsidiaries. As was the case with propensity to product innovation and firm size the results are not quite unexpected. In general large firms are more engaged in product innovation. Hence, it can be expected that they are more likely to collaborate with one or more external partners. Also, external relations are often interpersonal. Having more employees, the likelihood that a large firm has at least one collaborating partner increases (the survey includes formal as well as informal collaborative arrangements).

2.5. Distribution of collaborating partners across countries

There is considerable variation across countries with regard to the frequency of collaboration with different types of collaboration partners.

Figure 5: Distribution of Collaborating Partners: Austria, Denmark, Norway and Spain, 1997.



Source: Sanz-Menéndez et al. (1998), Schibany, A. (1998), Ørstavik and Nås (1998) and the DISKO-survey (1998)

As can be seen from figure 5 there is considerable variation with regard to the frequency of collaboration with different types of partners across the four countries. One of the most striking differences is with respect to universities and research centres which are very frequent collaboration

partners for Spanish firms (60%), rather frequent collaboration partners for Austrian firms (33%) but not very frequent as collaborating partners for Danish firms (17%). In the case of Norway, the 23% only refers to the use of universities as collaboration partners. 41% of the Norwegian firms have indicated co-operation with research institutes.

A possible explanation for this feature might be found in differences in institutional set-ups. One of the reasons why firms in Denmark might not use universities and public research institutions as frequently as collaborating partners compared to product innovating companies in other countries could be the broad range of technological services offered by intermediate technological service organisations which are part of the Danish GTS-system (Approved Technological Service System). Also, as pointed out by Sanz-Menéndez et al. (1998) the relevance of universities and public research centres as central actors within innovative networks is also controlled by the institutionalisation of research and development in a country. In Spain, in an environment dominated by public policies strongly aimed at fostering and subsidising or supporting collaboration between public institutions and business organisations, it is not surprising to find that universities and public research centres are the most frequently used collaborating partners. This strong policy orientation has been confirmed by the fact that in Spain around 67% of the firms involved in product development have received public support for what they identify as the most relevant project within the company⁶.

With respect to the fact that in Austria more than 70% of government R&D funding is devoted to the higher education sector (the highest percentage in the OECD) it is quite difficult to interpret the relative high co-operation rate with universities and public research institutes in Austria as a consequence of cuts in R&D funding (i.e. that universities are being 'forced' to become more entrepreneurially and commercially oriented). According to Jörg et al (1996) in Austria there are strong co-operation links between some specific university institutes and commercial firms in Austria reflecting personal relationships and initiatives of the firms. According to Jörg et al (1996) there is also a desire within the university sector for more co-operation and closer relationships.

The data also suggest that private customers are more frequent collaborating partners than governmental customers in all four countries (however the discrepancy between the frequency with which Danish firms collaborate with private and with governmental customers is larger than for the other countries). Further, whereas Spanish and Danish product innovating firms use suppliers of machinery and production equipment rather frequently as collaborating partners (49% and 44% respectively), the percentage is smaller in Austria (29%) and Norway (35%).

There are also some similarities across countries. In all four countries customers (private customers) and suppliers of materials and components are frequently used collaborating partners. In Denmark, Norway and Austria, they rank as the two most frequently used collaborating partners. In Spain, universities and research centres are the most common collaborating partners followed by suppliers of materials and components and customers. A possible explanation for the fact that links with

⁶ However, as pointed out by Sanz-Méndez et al (1998) due to the original composition of the data set used for the sampling of the empirical analysis the percentage is highly surprising and lower than expected. (See Technical Annex)

suppliers and private customers are among the most frequent collaboration partners in all four countries is that they are “close” to the actual market for which a company aims at developing a product. These results also emphasise the well known fact that supplier-buyer chains are extremely important mechanisms for the transmission of information and know-how (Lundvall, 1988).

Also, firms in the four countries more or less equally frequently use parent company or subsidiaries as well as competitors as collaborating partners. Except for Norwegian firms that indicate competitors as a more frequent collaboration partner than in the other countries (28%) only between 13% and 20% of the firms use competitors as collaborating partners. It is interesting to note, that the low rate of competitors’ participation in joint product development is also reflected in the subjective perception of the potential contribution of competitors to the overall process. For instance 17% of Spanish firms lack confidence in the contribution of competitors to the overall process. However, issues concerning market structure and the characteristics of competition in final markets have to be explored in order to understand the low frequencies of competitors as relevant partners and major sources of innovation. With regard to parent company and subsidiaries the percentages range between 33% and 39%.

2.6. Distribution of collaborating partners across countries according to firm size

The frequency of collaboration with different types of collaborating partners across countries varies according to firm size.

Figure 6 shows the distribution of collaborating partners according to firm size. In Austria, Denmark and Norway the most frequently used collaborating partners for all firm size categories are private customers and suppliers of materials and components. Among Austrian small firms with 10-19 employees, the least used collaboration partners are marketing and management consultants (6%) along with universities and research centres (9%). Among large Austrian firms with 100 and more employees, competitors (21%) and marketing management consultants (24%) are the least frequently used collaboration partners.

Among Danish firms with 10-19 employees the least frequently used collaborating partners are parent company or subsidiaries (6%) and universities and research centres (9%). Among Danish large firms with 100 and more employees, competitors (10%) and governmental customers (23%) are the least frequently used collaborating partners. Norwegian small firms least frequently collaborate with marketing and management consultants (17%) and universities (17%)⁷.

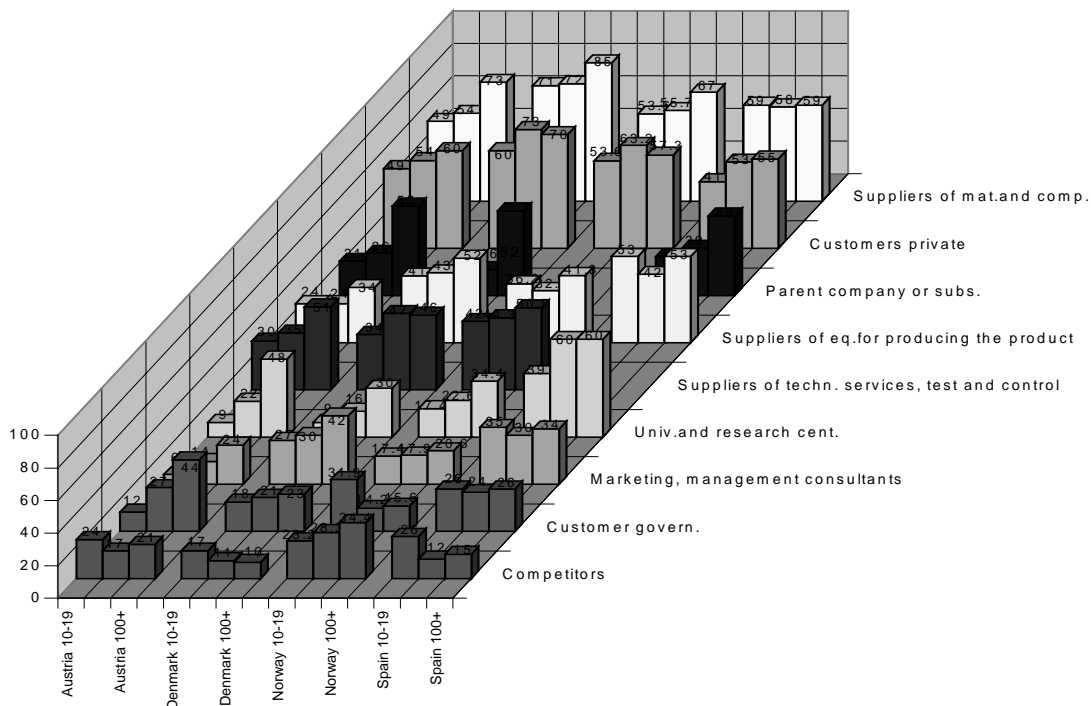
Spain deviates a bit from this pattern⁸ in the sense that universities and research centres are the most frequently used collaborating partners across all firm size categories (around 60%). Again, as

⁷ However, the Norwegian data on universities does not reflect co-operation with research institutes. 32% of small Norwegian firms have engaged in collaboration with research institutes.

⁸ However, it is important to stress that the total population of the companies surveyed with respect to collaboration and firm size is not that big and the data should be interpreted cautiously.

already mentioned, this feature possibly reflects the Spanish emphasis on fostering and subsidising or supporting collaboration between public institutions and business organisations. The least frequently used collaborating partners for Spanish small firms with 10-19 employees are parent company or subsidiaries (24%) and competitors (26%). For large Spanish firms with 100 and more employees the least used collaborating partners are competitors (15%) and governmental customers (26%).

Figure 6: Distribution of Collaboration Partners according to Firm Size: Austria, Denmark, Norway and Spain, 1997.



Source: Sanz-Menéndez et al. (1998), Schibany, A. (1998), Ørstavik and Nås (1998) and the DISKO-survey (1998)

In general there is a tendency for collaboration to be positively correlated with firm size. However, when we split up the data according to the frequency of collaboration with different types of collaborating partners according to firm size the pattern seems somewhat more complicated. In Spain the frequency of collaboration is only strongly positively correlated with firm size with regard to parent company and subsidiary. 24% of small Spanish firms with 10-19 employees use parent company or subsidiaries as collaborating partners. Among firms with 100 and more employees the proportion amounts to 49%. An obvious explanation for this phenomenon could be that the frequency of collaboration with subsidiaries or parent company tends to increase with firm size, because firms with subsidiaries are typically larger. Although the range of dispersion is small between the firm size classes, a positive correlation is also evident for private customers (41% of small firms and 55% of large firms), institutions for testing, control, certification and standardisation (47% of small firms and 60% of large firms) and other approved technological institutes (35% of small firms and 48% of large firms).

In the Austrian case for most of the different types of collaboration partners a positive correlation with firm size is discernible, except in the case of competitors. Austria has a significant positive

correlation in terms of collaboration and firm size with regard to governmental customers (12% of small firms and 44% of large firms), suppliers of materials and components (49% of small firms and 73% of large firms), universities and research centres (9% of small firms and 48% of large firms) as well as with parent company and subsidiaries (21% of small firms and 55% of large firms). In terms of contract research organisations, marketing and management consultants and suppliers of machinery and production equipment there is a positive correlation, but the range of dispersion between the firm size classes is very small.

Denmark exhibits a rather mixed pattern. A significant positive correlation between collaboration and firm size is evident for universities and research centres (9% of small firms and 30% of large firms) and parent company and subsidiaries (6% of small firms and 52% of large firms). A less significant positive correlation is evident for governmental customers, suppliers of machinery and production equipment, suppliers of technological services, testing, control and marketing and management consultants. Also, as in the case of Spain and Austria, no positive correlation is found between frequency of collaboration and firm size with regard to competitors.

In the case of Norway, an interesting pattern emerges. Most striking is the negative correlation between firm size and collaboration with governmental customers. 32% of small firms indicate collaboration with governmental customers whereas the percentage only amounts to 16% for firms with 100 employees and more. One of the most obvious explanations for this pattern might be the strong orientation of government (the so-called OFU contracts) aimed at engaging small and medium sized firms in collaboration on innovation projects. Another interesting feature is the fact that Norway is the only country where the data exhibits a positive correlation between firm size and collaboration with competitors. A plausible hypothesis, that needs further inquiry, could be that medium-sized firms in Norway are relatively isolated internationally and therefore aim at co-operating with international partners in order to gain a footing in international markets. There is a positive correlation between firm size and collaboration with regard to suppliers of machinery and production equipment, suppliers of technological services and a strong positive correlation between firm size and suppliers of materials and components, universities and research institutes (the data in figure 6 only refer to collaboration with universities). The data on research institutes indicate that 32% of small firms collaborate with research institutes whereas the percentage increases to 56% for large firms with 100 and more employees.

A common feature for Austria, Denmark and Norway is the strong positive correlation between firm size and collaboration with universities. As pointed out by Schibany (1998) this seems to be an expected result given that larger enterprises tend to employ highly qualified personnel and are more likely to have in-house R&D facilities. Large science-based firms might be better prepared to communicate with universities knowing their codes and their cultures, while smaller firms might have greater difficulties in these respects. In addition, small firms often do not have the personnel and financial resources in order to collaborate with universities. Another interesting result is that in relative terms, in Austria, Denmark and Spain, small firms seem to interact more frequently with competitors than large firms. In other words, it appears that small firms in those countries seem to be attentive towards their competitors and that for small firms the activities, practices and products of competitors may be easier to observe and access than for large firms.

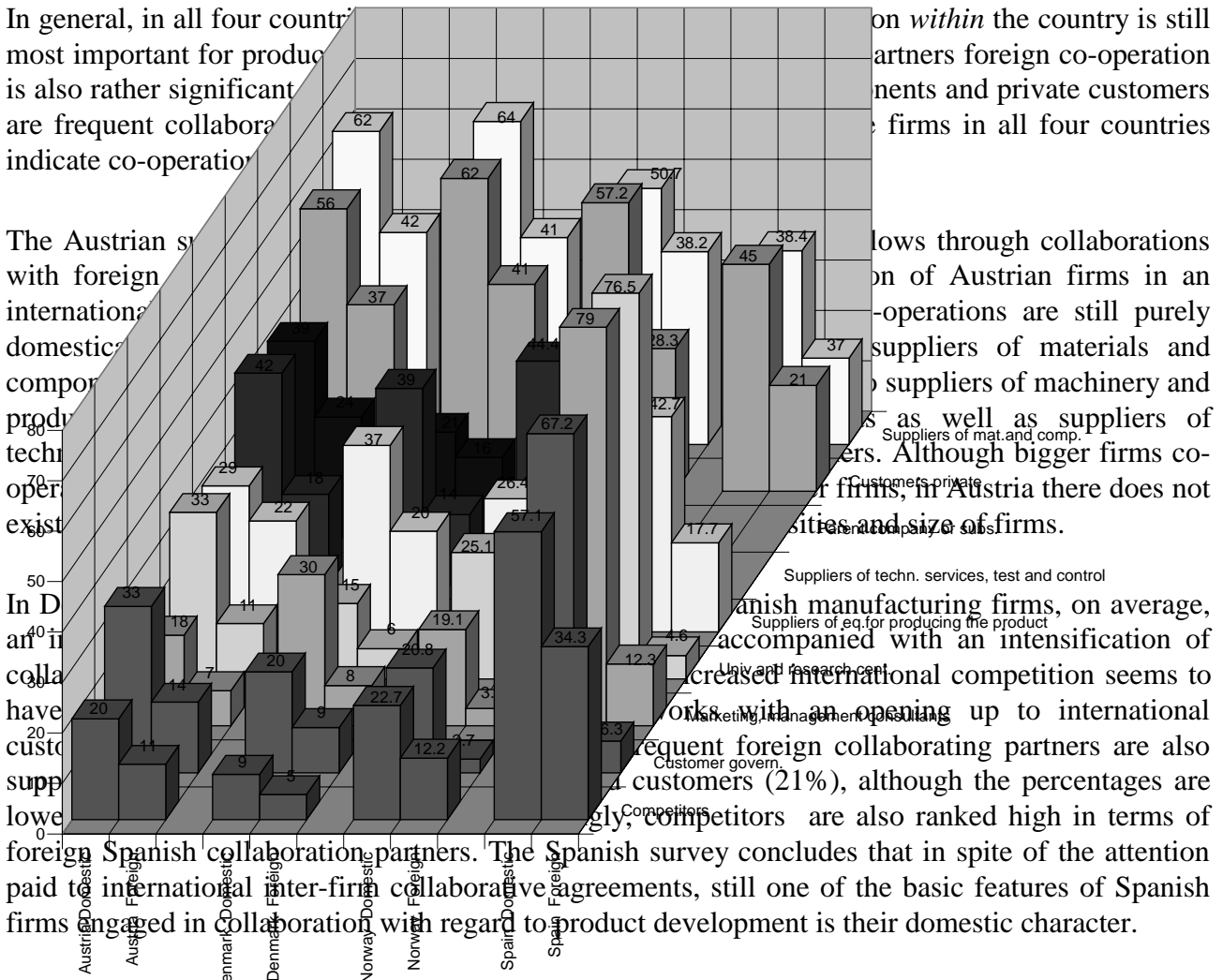
As a conclusion, it should be stressed that the empirical data show that the overall willingness to collaborate does rise with firm size. Yet the frequency of collaboration varies according to type of collaborating partner and firm size. The strength and direction of these relationships largely depends

upon the different partners potential as 'useful' sources of knowledge.

2.7 Domestic and foreign collaboration

Figure 7: Distribution of Collaboration Partners according to Domestic and Foreign Collaboration: Austria, Denmark, Norway and Spain, 1997.

Source: Sanz-Menéndez et al. (1998), Schibany, A. (1998), Ørstavik and Nås (1998) and the DISKO-survey (1998)



The data from Norway exhibits a similar pattern: Suppliers of materials and components (38%), private customers (28%) and suppliers of machinery and production equipment (24%) are the most frequently used foreign collaboration partners. As in the other countries, suppliers of technological services rank low as foreign collaboration partners.

It is interesting to note that in all countries technological services (suppliers of technological services, other private technical consultancies and marketing and management) largely seem to be appropriated in a national setting. A possible explanation could be that at the core of the “products” of knowledge-intensive services lies expert knowledge, problem-solving know-how etc. An inherent problem in “buying” information is the fact that the value of the information is unknown before the actual purchase. Accordingly, the choice of supplier is crucial to what you get. In a business, which

is rather opaque, firms might prefer to adhere to national collaboration partners, where additional problems like language barriers, differences in culture etc. are reduced.

Although the data are weak, and despite some variation between countries in terms of which collaborative linkages are foreign and which domestic, it is still interesting to see that the overall propensity to collaborate with different foreign partners is generally very much alike, especially for Austria and Denmark. Spain which is larger than both Austria and Denmark deviates (however only) slightly from the general pattern by generally collaborating *less* frequently with foreign partners. A natural hypothesis would be that small countries might be more internationally oriented in terms of networking than large countries. All things kept equal, large countries might be expected to have a larger variety of technical competencies within the national boundaries than a smaller country. However, it is too early to draw conclusions in this regard and we still have to await and compare data from other participating countries like Italy, France and UK.

2.8. The importance of trust and confidentiality

Stability and continuity in the network formations and clusters.

As pointed out by Dodgson (1996) co-operation must have a social basis involving affinity and loyalty. Given the social basis of inter-firm co-operation, the quality of the relationships between partners has obvious implications for the outcomes. It is a well known fact that the most important determinants of these relationships are trust and confidentiality, reputation of the partner and fairness. A wide range of studies have shown how intensive inter-firm links and learning between partners depend on high levels of trust. For example, Lundvall (1988) argues that in order to overcome the inevitable uncertainties in jointly developed product innovations, “[...] mutual trust and mutually respected codes of behaviour will normally be necessary”. In prolongation, collaborative arrangements are strongly dominated by cultural affinities and social settings. Freeman (1991) argues that “personal relationships of trust and confidence (and sometimes of fear and obligation) are important both at the formal and informal level [...]. For this reason cultural factors such as language, educational background, regional loyalties, shared ideologies and experiences and even common leisure interests continue to play an important role in networking”.

A number of reasons can be suggested to explain why high trust facilitates effective inter-firm co-operation (Dodgson, 1996). The first relates to the sort of knowledge being transferred which is often tacit, uncodified, firm-specific and more or less commercially sensitive. It is therefore not immediately transferable and requires some dense and reliable communication paths. Partners are expected to share trust in each other's ability to provide valid and helpful responses to uncertainty. Furthermore, they are trusted not to use this information in ways which may prove disadvantageous to partners.

Some preliminary results on factors like trust are available for Austria and Denmark. In Austria more than 70% of all co-operating firms fully agree that trust and confidentiality are important prerequisites for co-operation. In Denmark the percentage amounts to 60%. Compared to these results only 24% of Austrian co-operating firms and 22% of Danish co-operating firms consider the necessity of passing a trial period with the partner before committing substantial resources to collaborative development as important. Hence, it seems as if a high level of trust (or mistrust) between the contracting partners is perceived *ex ante*. If the partners have confidence in each other

from the outset, trust prevails in their mutual commitment. It is clear, that the attitude of ex ante trust is a matter of history, past experience and of the reputation of the partners.

3. MAIN FINDINGS AND POLICY IMPLICATIONS

3.1. Collaboration on product innovation is widely used

Firms rarely innovate alone. The CIS-surveys as well as the EuroDISKO survey carried out in Austria, Denmark, Norway and Spain bear evidence to the fact that firms rarely innovate alone. In addition, in all the countries the data bear evidence to the fact that there seems to be a positive correlation between firm size and product innovation. However, the data also reveals that collaboration in relation to product development is not confined to large firms. Also in the small firms segment many firms choose to collaborate.

One of the reasons why networks are attractive may be rapid rates of change in technologies and production and the need to establish flexible and learning organisations. In this context, inter-firm co-operation can be said to represent a response to contradictory demands on the competencies of the firm. On the one hand it is necessary to concentrate on core competencies in order to be able to follow the innovation race. On the other hand there is a need to have access to a wider set of technical competencies in order to remain competitive in a specific product area (Pavitt, 1998). To resolve this, firms focus on their core activities while using closer relations with suppliers, customers, competitors and others as sources of complementary competencies when the need for them arise. Although the data show that co-operative agreements are an integral part of the innovation process, it should be stressed that co-operation itself is not cost-less. It has to be managed with a clear view of the outcome and its benefits depend very much on factors like trust and past experience as well as knowledge of the competencies of the partner.

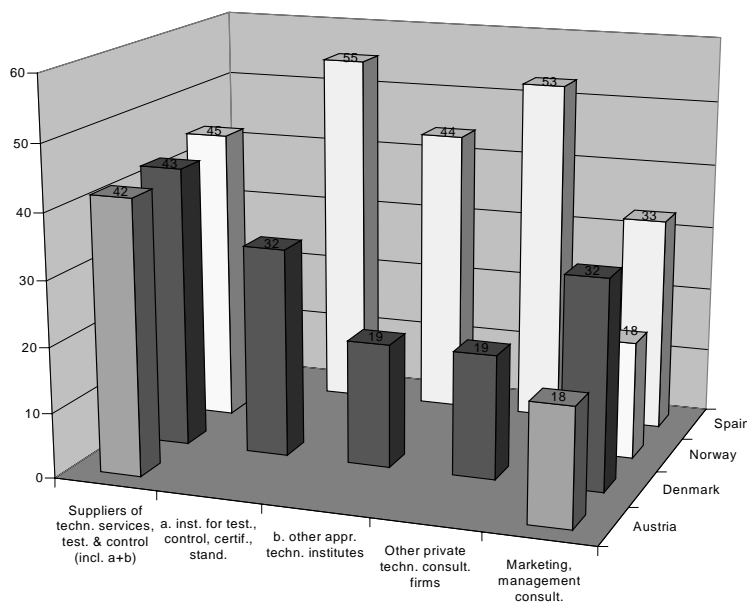
An immediate implication is that innovation policy should not focus on the single firm in isolation but rather on its capability to interact with other organisations and on the formation of innovative networks. This is, however, a rather general statement. More specifically, we see a role for government, national as well as regional, to establish fora where potential partners meet. Similar programmes have been introduced at other levels in EU as investor fora where firms present themselves to potential investors and at a regional, or even local level (e.g. branch clubs, after-job arrangements, etc. where people from different firms can meet informally and maybe establish the first contact).

3.2. The relative importance of collaboration partners

One feature deserves particular attention: The role of knowledge-intensive service firms in the innovation process. The data indicate that *manufacturing firms today are interacting intensively with knowledge-intensive service firms* which in turn implies that service firms and sectors play an

important role in the innovation process. Both the CATI-data and the CIS-type data show that roughly between 30-50% of the surveyed firms had established a co-operative link with consultancy, technological service firms etc. This does not point in the direction of any technology-push model of innovation policy. Down-stream collaboration partners like customers are also important, and universities are not important in all countries.

Figure 8: Collaboration and Knowledge-intensive Services: Austria, Denmark, Norway and Spain, 1997.



Source: Sanz-Menéndez et al. (1998), Schibany, A. (1998), Ørstavik and Nås (1998) and the DISKO-survey (1998)

At the core of the “products” of knowledge-intensive services lies specialised expert knowledge, research and development abilities, problem-solving know-how etc. (Strambach 1997). In this vein, it can be argued, that knowledge intensive services provide a diversity of specialist expertise, which (if the firms succeed in utilising this knowledge) enhances firms’ abilities to adjust more rapidly to a continuously changing environment posing new threats and challenges. In prolongation, the knowledge-intensive services can be said to illustrate a high demand for new learning and change within firms and organisations. Further, as revealed in connection with in-depth interviews in the Danish DISKO-survey and as pointed out by Sanz-Ménendez et al. (1998), technological services such as testing and control institutes also play another important role: by acting as external to the firm they provide legitimacy concerning the quality of technological and innovative activities of firms. Thus, factors such as technological skills and legitimacy on technological actions and initiatives place the knowledge-intensive services as major players within the development process.

This points to the need for an industrial policy that gives stronger attention to networking around

service firms and that proactively encourages the use of these services as a way of enhancing the organisational and technological transformations of firms. Innovation policy must be alert in at least two respects: An inherent problem in buying information is that the value is not known before the purchase. Equally, the choice of supplier is crucial to what the firm actually gets. Needless to say, this choice is very difficult and could be facilitated by government guidance to what specific kind of knowledge the firm can buy from specific suppliers. An important policy task is to increase the transparency of the market for knowledge-intensive services. In prolongation, an important element of encouraging the use of knowledge-intensive services would be to build trust among potential users. As pointed out by Lundvall and Borras (1998), quality control, i.e. instruments and institutions for controlling the quality of knowledge-intensive services, could be a crucial mechanism for achieving this. Another important policy task is to ease the *accessibility* of (especially small- and medium sized) firms to knowledge-intensive services by promoting networks and partnerships actively involving firms and specific knowledge-intensive services for the definition of strategic innovative actions.

3.3. Informal networks and trust are important

The survey has also shown that informal information exchange is very important, and that the knowledge is often embodied in people rather than organisations. In light of the fact that firms to a large degree collaborate with suppliers of technological services and knowledge “producers” like universities, and in light of the fact that innovation rests on an increasingly more unstable and complex knowledge base (increasingly, innovations have to integrate several disparate technologies and each technology becomes more and more dependent on a number of separate scientific disciplines), promotion of mobility of people is likely to enhance networking on innovation, in particular the informal knowledge exchange. For some firms the absorption capacity may not be adequate in relation to exploiting codified, new research results. However, such firms may benefit from *collaborating* directly with either the knowledge producing entity or an intermediary like technological institutes, thereby learning from the more tacit aspects of new knowledge. As mentioned an even more intense form of such knowledge exchange would be to promote mobility of researchers between universities, research and technology organisations and firms (cf. The Training and Mobility of Researchers Programme in The EU), as well as programs for upgrading of absorption capacity.

The evidence of certain inertia in terms of stability and continuity in the network formations and clusters seems to suggest that it takes time and resources to build efficient communication channels which seemingly rest on more “soft aspects” such as culture, personal experience and mutual trust.

A wide range of studies have shown how intensive inter-firm links and learning between partners depend on high levels of trust. This also applies to study despite the present scarcity of data on this matter. In particular, it seems as if a high level of trust (or mistrust) between the contracting partners is perceived *ex ante*. If the partners have confidence in each other from the outset, trust prevails in their mutual commitment. It is clear, that the attitude of *ex ante* trust is a matter of history, past experience and of the reputation of the partners.

The inertia in terms of stability and continuity in the network formations and clusters points to a dilemma for innovation policy in terms of continuity/renewal. On the one hand, certain continuity seems to be an important and necessary pre-requisite for establishing well-functioning channels and mechanisms for knowledge exchange (e.g. common codes of communication) and it is certainly

easier for innovation policy to support network formations and clusters which are already well-established. On the other hand, there might be a need for policies that establish new ones in order to ensure knowledge diffusion.

3.4. International links are strengthened simultaneously with domestic links

Differences between domestic and international innovation relationships are fundamental for understanding the dynamics of globalisation and national systems of innovation. Investigating the patterns of collaboration, in terms of “with whom do which firms collaborate”, might highlight another central question namely to which extent innovation systems are national or international respectively. Empirical data on such developments over time mapping changing configurations in this respect are still weak, but they do seem to indicate *a growing frequency of international relationships* - especially for the firms most active in innovation.

In general, in all four countries the data point to the fact that collaboration *within* the country is still most important for product development. However, for some types of partners foreign co-operation is also rather significant. It is interesting to note, that suppliers of technological services are predominantly domestic and suppliers of materials and components and suppliers of machinery and production equipment rank high as foreign collaboration partners. This nourishes the argument, that it is relatively easier to engage in collaboration with international partners when the co-operation predominantly relates to the exchange of artefacts or tangibles whereas when co-operation involves exchange of tacit, uncodified or disembodied knowledge, the collaborative arrangements become strongly dominated by cultural affinities and social settings.

In general, it seems plausible to conclude that the lower rate of foreign relationships probably occurs both because of the fact that the historical development of the industrial structure of a country depends more or less on the types of knowledge and skills within the country and because individuals might find it easier to develop contacts and co-operate with people from the same cultural and linguistic background.

3.5. There is a wide variation in National Innovation Systems

From results of the EuroDISKO, survey it has become evident that there is a considerable variation between national innovation systems both in terms of the extent to which firms interact with different collaboration partners and in terms of whether collaboration is pursued with domestic or international partners. The national system might be said to have become even more important than before in the phase of globalisation. There are important differences in the way innovation is pursued, differences which are also reflected in institutional frameworks. Therefore, any innovation policy faces the complex task of simultaneously building domestic relationships that increase the coherence of the national system while linking up domestic firms to international production and innovation networks. Taking the argument a step further, in a European context complex trade-offs between establishing local, regional, national, European and global networks might be anticipated.

4. Future work

Even at this stage of the work it may be concluded that the objectives of the focus group – to establish collaboration on harmonised data collection on inter-firm networks in order to better

understand this aspect of NIS - has been achieved. The results as they stand thus increase our knowledge on inter-firm collaboration.

The results from the four countries, which have finished the CATI data collection, point to some of the potentials inherent in this approach. It seems to be a fruitful way to reveal and compare national innovation systems not only in terms of what type of collaborating partners are the most frequent with regard to product innovation but also what type of partners and forms of co-operation (vertical, horizontal, lateral or conglomerate) are typically domestic and which are international.

There is, however, still lots of work to be done, both on the data as they stand, and on further data collection. It is envisaged that the work in the focus group will continue with

- more detailed analyses of the existing data
- more countries may complete a survey
- it will be considered if longitudinal studies should be pursued, which involves another round of interviews with the firms at a later stage. This would allow analyses on the stability of collaboration patterns found in the present round of data collection.

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