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The Norwegian Innovation-Collaboration Survey

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Preface

The Norwegian Innovation-Collaboration Survey has been undertaken as part of the STEP group's research on National Innovation Systems (NIS). The OECD has coordinated research in this area by way of its NIS research programme. We thank our collaboration partners which have taken part in this research, in particular our Danish colleagues at the IKE group who originally initiated this work. Not least we wish to thank the OECD secretariat, which has done a major effort in coordinating the work and synthesising contributions from the different countries.

We also with to thank the Norwegian Research Council which has given substantial financial support for our research in this important area.

Oslo, December 1998

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Abstract

This working paper presents the Norwegian Innovation-Collaboration Survey carried out by the STEP group during 1998. The paper presents the theoretical background for the survey, discusses the methodology employed, and presents the content and analytical potential of the dataset generated. The paper also touches upon a few of the substantial research issues which can be fruitfully explored with this particular data set as (part of the) empirical basis.

Keywords: Innovation; Collaboration; Manufacturing industry

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The Norwegian innovation-collaboration survey

1. Introduction

This working paper is a first report on the contents and results of the Norwegian innovation and collaboration survey which the STEP group carried out during 1998 as part of its National Innovation Systems research effort. The work has been supported by the Norwegian Research Council.

The research programme on *National Innovation Systems* (NIS) was established under the OECD **Directorate for Science, Technology and Industry** (DSTI) in June 1994. The programme has targeted issues relating to science and technology, information and communications technologies and industry. The objective has been to develop and test a conceptual framework for analysing the processes of knowledge creation, distribution and use in national systems of innovation. Research groups in several OECD countries have collaborated in seeking to map and to compare knowledge flows in national innovation systems, with a view to developing new technology and innovation policy approaches for the knowledge-based economy. The conceptual framework has been developed and tested through pilot country studies in order to identify the main indicators for mapping national systems of innovation, experiment with different analytical approaches and draw conclusions about "systemic approaches" to innovation and technology policy.[1]

This working paper contains

- a description of the theoretical and analytical background for the survey,
- a discussion of the data collection strategy utilised and a few related methodological issues,
- an overview of the data set which has been compiled, together with a few examples of analytical issues that can be investigated with the data set.

[1] See references in the back for information on other NIS-related STEP reports, and a selection of relevant NIS reports from other countries.

2. Theoretical and analytical background for the survey

Modern innovation research has brought forth firm support of the claim that innovation happens in interactive processes of development and learning. Thus, the claim that *there is a fundamental one-way flow from the depths of pure science into the economic realm of production and exchange* (the "linear model") is proven wrong. The common view that economically important innovations invariably have their origins in advances in science and in - pure science's sibling - advanced technology, is wrong.[2] Rather, it is claimed, innovation has its roots in complex collaborative constellations, where scientific and technological developments certainly may be important, but where the striving of business firms to develop their activities and their markets play the decisive role.

Although the analytical problem of understanding the interrelationship between science, industry and growth may not have been done away with completely - as argued for instance in Hauknes (1998a) - a rich empirical literature actually has shown that innovation efforts involve complex institutional structures and intricate interactions between a number of stakeholders.[3] Indeed, several theoretical contributions have convincingly argued that innovation in its very essence concerns interactions, rivalry and collaboration.[4] Furthermore, there is a rich literature detailing the nature of interactions taking place in the course of innovation processes.[5]

But there is still a lack of specific knowledge concerning the extent of collaboration during innovation efforts, what actual partners are involved, etc. Most of the research that has been done has been focusing on *cases*. The study reported here is an attempt to fill some of the empirical void concerning quantitative aspects of collaboration in connection with innovation.

As we advance our analysis of innovation beyond the linear model (of subsequent phases of activity leading us from pure science to commercial operations), we need to confront one very consequential implication: If innovation is the result of collaborative development and interactive learning, then innovation should be the outcome of the workings of a *system* and not of the efforts of isolated actors. In other words: The individual actions that bring forth innovation must be understood as actions of individuals that are members of a social system. We can obviously involve the whole body of sociological theory and social philosophy to answer this question. But that, obviously, cannot be done. Suffice it to say that the systemic and social nature of the actions which constitute innovation processes makes it evident that innovation processes have an important cultural dimension – and this cultural dimension is as important for the analysis of innovation, as is the individualistic and maximising dimension of actions that the common economic approach to innovation analysis and innovation

[2] See for example Edquist (ed.) 1997 or OECD 1992.

[3] See for example Moss Kanter 1983, Drucker 1985, Burgelman and Sayles 1986, Van de Ven et. al. 1989, Wicken (red.) 1994, Van de Ven and Scott Poole 1995.

[4] Two references are Latour 1987, Bijker et. al. 1989.

[5] A good example is Van de Ven and Garud 1993.

policy is so much relying on. The explanation of innovation processes and results cannot but take seriously the *social context* within which innovation is carried out. *The institutional context* (both the cultural and organisational dimension of this context) have significant impact on innovation, and are necessary parts of any explanatory scheme that aspires to account for any specific instance of innovation.

This is important both for theoretical and for empirical reasons.

(i) In the effort to clarify the nature of innovation in modern economies, empirical knowledge about firm behaviour with respect to collaboration is pertinent. Theories about economic(ally relevant) action often relies on an individualistic meta-theory about social reality: Social action is but the aggregate of individual actions. Furthermore, important social-science traditions build on conceptualisations of individual actions as rational and optimising action, as actions designed to attain specific purposes for the acting individual. The concept of innovation as "maximising the economic returns of new scientific discoveries" is obviously part of the rationalistic and individualistic tradition in social science. The concept of innovation as "interactive learning in a social context" is not. Thus, doing research on collaborative behaviour in innovation promises to give new insights with relevance for this fundamental and long lasting theoretical debate within social science.

(ii) When we realise that the context of innovative behaviour is a crucial determinant of the course and content of innovation processes, it becomes clear that the comparative analysis of innovation efforts in various regions and countries is extremely interesting in a scientific perspective, as well as it is interesting in a policy perspective. Comparative data would appear to be the only way to get reliable knowledge concerning the regional and national specificity of the socio-technical, organisational, institutional and cultural context which has such a decisive impact on the overall innovation performance of an economy.

3. The data gathering approach of the innovation-collaboration survey

3.1. A computer aided telephone survey

The starting point for this innovation-collaboration survey was a study carried out in Denmark, by Bengt-Åke Lundvall and his collaborators at the IKE-group in the University of Aalborg. The effort appears to have been motivated by theoretical concerns, but also by results from and experiences with the first Community Innovation Survey (CIS).

The Community Innovation Survey (CIS, 1992) and the Policies, Appropriability and Competitiveness for European Enterprises Survey (PACE, 1995) were cross-European efforts aimed at this kind of data gathering. These were rather general, first attempt surveys. The joint effects of conceptual vagueness, difficulties in developing a questionnaire acceptable and adequate for all countries, and low response rates in some countries caused the CIS data sets to suffer from limitations with respect both to data reliability as well as to comparability of data from the different countries.[6] In addition CIS only to a limited extent addressed collaboration issues.

The pioneering Danish survey was designed as a rather narrowly focused data gathering effort, concentrating on building the fundament for a later international effort to build comparable data sets on issues related to collaboration and innovation. Reflecting this ambition, the group also applied a more effective data gathering methodology than the conventional paper questionnaire survey method. A concise set of questions was implemented in a computer assisted telephone interviewing system.

Under the OECD NIS umbrella, a common approach for empirical work was agreed upon between groups of researchers from several countries. This approach was based on the same use of computer aided telephone interviewing and on a thoroughly revised version of the questionnaire first implemented by the Danes. The aim of the work was to try to bridge the gap between the increasing focus on the collaborating, network embedded firm on the one side, and the lack of systematic empirical data on how, why and with whom firms interact in product innovation on the other.

The advantages of the telephone interviewing approach are considerable. Compared to face-to-face interviewing, the resources needed are very much smaller, and still, not very much is lost with respect to the processing of answers that lies between listening to answers and coding them into data tables. In comparison with mailed questionnaires, the telephone interviewing method is significantly more powerful, since most of the coding responsibility is transferred from the respondent to the interviewer. The experiences in the Norwegian research team is that in spite of careful wording and the careful approach used when introducing complexity into the questions, the control gained over the interpretation of questions and answer alternatives was extremely important. There was a huge

[6] Christensen and Rogaczewska 1998, page 3.

data-quality gain inherent in keeping the interviewing job in-house; to let the researchers themselves do a significant part of the interviewing job, and to use the experiences made on this job actively when instructing extra personnel for doing the remaining part of the interviewing job.[7]

3.2. Overview of the data set

The result of the joint effort to develop a common set of research questions was a compromise: An agreement was struck to use a set of common core questions, and opened up for the different national teams to implement their own modules in addition to the core questions.

The Norwegian survey was designed to cover a random sample of manufacturing firms. It was focused on product innovation, not process innovation nor organisational innovation.

The core questions covered the following themes:

A. BASIC INFORMATION ON FIRM - Data on the size of firms

- number of employees
- turnover
- industry (NACE code)
- geographical location
- organisational position (mother, daughter, sister)

B. INNOVATIVENESS - The firms were asked whether they during the last 3 years had

- commenced sales of any technologically new products
- introduced to the market any new services (sold part and parcel with the manufactured products)

Then they were asked if

- they currently were undertaking development of a new product which weren't yet introduced into the market.

C. COLLABORATION – The innovative firms were asked:

- Had the firm developed any technologically new product in collaboration with other companies or other organisations?

[7] An implication of this is that even if great care was taken to develop a set of core questions common for all participating national research teams, the actual interpretations and assumptions made would necessarily reflect national and cultural specificities. Thus, comparability of data is even in this case not a given. It is important to consider to what extent national teams found similar problems, and found similar solutions to the difficulties that were encountered.

- What kind of partners has the firm collaborated with on product development?
- Which of the partners are parts of the same corporation as the firm interviewed?
- How often does the company collaborate when it is engaging in product development?

D. COLLABORATION PURPOSE AND SIGNIFICANCE IN A SELECTED PROJECT

- What was the objective of the single most important collaborative development project in your firm during the last 3 years?
- How many man-years have your company invested in this project
- How long has the project been going on?
- Which types of partners have been involved?
- Why did you choose to collaborate with them?
- How important did the different partners turn out to be for the project as a whole?
- Have your firm collaborated with the same partners earlier?
- If so, for how long?
- How many persons from your partner have been involved with this project?
- Did you make a formal contract with them concerning sharing of costs, secrecy and/or sharing of profits resulting from the development effort?

E. NATURE OF INTERACTION IN MOST IMPORTANT PROJECT

- What methods did your firm use to transfer or otherwise obtain control over results from the collaboration?
- How important where the different methods for transferring results in this particular case?

F. RESULTS OF MOST IMPORTANT PROJECT

- Is the new product introduced onto the market yet?
- Did the project keep the time table?
- Did the project keep the budget?

While questions in A-C concerned the firm in general, the questions under D, E and F concerned a chosen innovation effort, namely the most important project - completed or uncompleted at the time of interviewing - undertaken during the last three years and which involved collaboration with external partners. The base data were gathered for all firms (A). The questions under (B) were asked to all firms willing to participate; the remaining questions (C+D+E+F) only to firms that had been innovative and had collaborated in the course of the last three years.

3.3. Methodological issues

How comparable are the data, and how valid are they? As mentioned earlier, the interviewing method secured a much better way of getting hold of information than what is possible with mailed questionnaires. The dialogue which takes

place in a phone conversation secures a level of common understanding, and secures a significantly higher level of data validity than what one can expect from standard questionnaires.

Also, it proves to be much easier to get in contact with people using telephone interviewing. In the Norwegian case, the cases where we could not find the right firm, where the firm turned out to be irrelevant for the survey for some reason, or where the people actually said no, when asked to participate was very low.

It adds to the validity of data when the analysts themselves have done a substantial part of the interviewing effort. This gives a very close understanding of the questionnaire, and any terminological or conceptual difficulties that the wording of questions brings.

There are three potential pitfalls we will highlight with respect to the survey methodology employed:

First, that the challenges facing interviewers are considerable, both in presenting their case to the firms selected, as well as in actually carrying out the coding work which makes it possible to bring answers over to data in the computerised questionnaire. It is extremely important that interviewers are familiar with the structure of the questionnaire, what the questions are precisely, and what kind of answers are asked.

Second, and this obviously is related to the first issue, there are real terminological and conceptual challenges inherent in the questions asked. What is collaboration – when does interaction become collaboration? Is it enough to buy components from a supplier one or more times, or is some kind of interactive process involved beyond the exchange? What is *technologically new*, when a company is producing food products? Is a shipyard producing a technologically new product when it is building a large ship of a shape or size that it hasn't produced before? What is product development in a newspaper publishing company?

Third, and finally, there is a difficulty in handling the complex organisational structure of modern manufacturing industry. There is a problem in determining at what level to approach conglomerate firms and corporations: How should holding companies for manufacturing firms be dealt with? When a company is called, but say they only are a part of a larger structure and that it is meaningless to ask them about product development, what do you do with that? In general, how do you handle that for a significant subset of firms, the distinction between mother, sister and daughter companies is an utterly impotent and misleading set of concepts?

Answers for these questions had to be worked out in the course of the survey. Within the research team a common understanding of how to deal with different borderline cases was developed. However, it is hard to communicate and agree upon sufficiently exact definitions between countries. Therefore the international comparisons will be particularly hampered by these problems.. In this report, however, only Norwegian results are reported.

3.4. Population, selection and sample

The sample for the Norwegian survey was constructed on the basis of Statistics Norway's business register. From the 1994 data, manufacturing firms with 10 or more employees belonging to manufacturing industries (NACE categories from 15 to 36) were selected.[8]

This population consisted of 4438 firms, and was sampled by selecting all firms with 100 or more employees, and 20% of smaller firms. The 20% sample was randomly drawn in a stratified, representative sample. Strata were defined as combinations of firm sizes in terms of number of employees, and industry class in terms of NACE code assigned to firms by Statistics Norway.

Tables 1, 2 and 3 summarise the selection process.

Table 1: The survey population and sample

The population	4 438	NACE 15-36 and 10+ employees
"The census"	572	100+ employees
Sampling basis	3 866	10-99 employees
"Sample"	776	20% stratified (NACE/Size)
Census + sample	1 348	Sum selected units
Removed	73	Irrelevant or non-existent units
Survey	1 275	Included in CATI[9] survey

[8] NACE: Nomenclature générale des Activités économiques dans les Communautés Européennes

[9] CATI: Computer Aided Telephone Interview

Table 2: The relevant industry categories

NACE-code	Units in population	Description of industry type
15+16	993	Manufacture of food products and beverages (15) Manufacture of tobacco (16)
17+18+19	194	Manufacture of textiles (17) Manufacture of wearing apparel; dressing and dyeing of fur (18) Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear (19)
20	365	Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	75	Manufacture of pulp, paper and paper products
22	528	Publishing, printing and reproduction of recorded media
23+24	135	Manufacture of coke, refined petroleum products and nuclear fuel (23) Manufacture of chemicals and chemical products (24)
25	154	Manufacture of rubber and plastic products
26	183	Manufacture of other non-metallic mineral products
27	92	Manufacture of basic metals
28	435	Manufacture of fabricated metal products, except machinery and equipment
29	370	Manufacture of machinery and equipment n.e.c.[10]
30+31+32+33	265	Manufacture of office machinery and computers (30) Manufacture of electrical machinery and apparatus n.e.c. (31) Manufacture of radio, television and communication equipment and apparatus (32) Manufacture of medical, precision and optical instruments, watches and clocks (33)
34+35	386	Manufacture of motor vehicles, trailers and semi-trailers (34) Manufacture of other transport equipment (35)
36	263	Manufacture of furniture; manufacturing n.e.c.
Total	4438	

[10] n.e.c.: *Not elsewhere classified*

Table 3: Stratification and sampling: Number of units of the gross population (Pop) and of the units actually contacted (Con)[11]

NACE code	Size class													
	10-19		20-49		50-99		100-199		200-499		500+		All	
	Pop	Con	Pop	Con	Pop	Con	Pop	Con	Pop	Con	Pop	Con	Pop	Con
15+16	373	60	369	61	144	24	69	54	30	28	8	7	993	234
17+18+19	88	16	65	12	30	5	10	10	1	1	0	0	194	44
20	181	32	119	20	42	8	18	15	5	3	0	0	365	78
21	13	3	20	4	14	2	17	12	6	3	5	4	75	28
22	273	48	157	24	46	6	39	29	10	9	3	3	528	119
23+24	36	4	32	5	19	2	22	13	18	14	8	6	135	44
25	68	12	53	10	20	3	10	8	3	3	0	0	154	36
26	79	15	57	8	25	4	17	15	5	4	0	0	183	46
27	18	4	24	3	14	1	11	7	18	16	7	6	92	37
28	198	36	162	32	57	11	14	11	4	2	0	0	435	92
29	164	22	96	12	69	11	25	17	12	11	4	4	370	77
30+31+32+33	105	14	76	14	37	7	22	19	19	15	6	4	265	73
34+35	117	19	119	15	47	6	57	40	32	25	14	6	386	111
36	102	19	100	17	38	6	15	13	7	6	1	1	263	62
Total	1815	304	1449	237	602	96	346	263	170	140	56	41	4438	1081

3.5. Response rates

Table 3 demonstrates that we had imperfections in our data on firms: Not all firms in the population could be found when we tried to call them. Partly this was to blame on relatively old business register data (1994): Several firms, especially of small and medium size had changed name, merged, stopped operating or could not be traced for other reasons. Additionally, there was a problem with holding companies and large corporations: Our questionnaire was designed for manufacturing firms. In some cases holding companies and administrative bodies of large corporations could not be classified as manufacturing firms (it would not be meaningful to ask the questions in our questionnaire). Thus, we chose to remove them from the survey sample.

Of the 1275 firms which was included in the original sample, we found and were able to request participation from 1081 companies. 73,7 percent of these agreed to participate in the survey, a response rate which is much higher than what we would have expected from an ordinary mail survey. Table 4 details response rates in the survey.

[11] "Pop" refers to the original population of firms from 1994 data; all firms in relevant statistical categories and with 10 or more employees. "Con" is the firms that we managed to contact by phone and pose the question whether they wanted to participate in the survey or not. The basis for this was a 100% selection of firms with 100 or more employees, and a 20% stratified random sample of the smaller firms.

Table 4: Response rates, by size and industry. Percent of firms which agreed to participate of all firms asked.

NACE Size	15 16	17 18 19	20	21	22	23 24	25	26	27	28	29	30 31 32	34 35	36	All
10-19	66,7	56,3	71,9	100	66,7	100	75	86,7	50	66,7	72,7	85,7	73,7	57,9	69,7
20-99	68,2	82,4	71,4	66,7	60	85,7	84,6	58,3	75	60,5	91,3	71,4	71,4	82,6	71,2
100-	78,7	81,8	61,1	89,5	80,5	81,8	90,9	63,2	86,2	84,6	75	84,2	71,8	80	78,4
All	71,8	72,7	69,2	85,7	69,7	84,1	83,3	69,6	81,1	66,3	79,2	80,8	72,1	74,2	73,7

The results presented in this report are scaled on the basis of our stratified sample according to the realised coverage of the sample. We have used the fraction TOTAL POPULATION/NET SAMPLE where 'total population' is the number of relevant firms in the register data, and the net sample is the number of firms that participated in the interviews.[12]

[12] Relevant firms in the register data are all the firms in our 20% (10-99 employees) sample and in the 100% census (100+ employees), except a few firms that were removed before the start of the survey because they were considered to be erroneously included in the sample due to weaknesses in the business register data from which the sample was drawn. (Mostly non-manufacturing firms.)

4. Some results

The full richness of the database is presently far from exhausted. Below we report selected results on some of the basic issues addressed in the survey. They include the numbers and shares of innovative and collaborating companies, the distribution on different kinds of partners, evaluation of the contribution of the partner according to type of partner, and the methods for transferring information and results of the collaboration between the partners.

4.1. Innovation and collaboration

Of the firms surveyed, how many were innovative? And how many of the innovative firms where engaging in collaboration with external partners, as part of the innovation effort? On the basis of our stratified, random sample, we are in a position to answer these questions. The following table 5 shows innovation rates and collaboration rates for Norwegian manufacturing firms.

Innovation is present when a firm has introduced a new product, or a new service related to products sold by the firm, over the last 3 years, or when a new product is presently being developed that has not yet been launched on the market. A change in how products are manufactured, and organisational change or a technical process change, are not counted as innovation in this survey.

Collaboration refers to real interaction between partners that jointly contribute to the innovation. When a firm buys well-defined intermediary products or services without any contribution of their own, this is not counted as collaboration.

Table 5: Innovation *and* collaboration in order to innovate *among Norwegian manufacturing firms with 10 or more employees. 1998. Percent.*

Employees	Number of firms[13]	Innovative	Of which collaborating[14]
10-19	1815	49,9	67,0
20-49	1449	57,9	70,5
50-99	602	31,2	71,3
100-199	346	68,5	89,5
200-499	170	76,7	92,8
500+	56	83,1	97,0
Total	4438	52,9	72,9

In general, data provide strong evidence that innovation to a large degree happens in collaborative constellations. A large majority of firms report that they do collaborate when undertaking innovative efforts and the tendency to collaborate seems to be stronger in larger firms. The share of innovating firms also is somewhat higher than previously found in for instance the CIS surveys. We believe

[13] This is the number of firms (in the relevant sectors in the Norwegian industry) that the *scaled* numbers in columns 3 and 4 refer to.

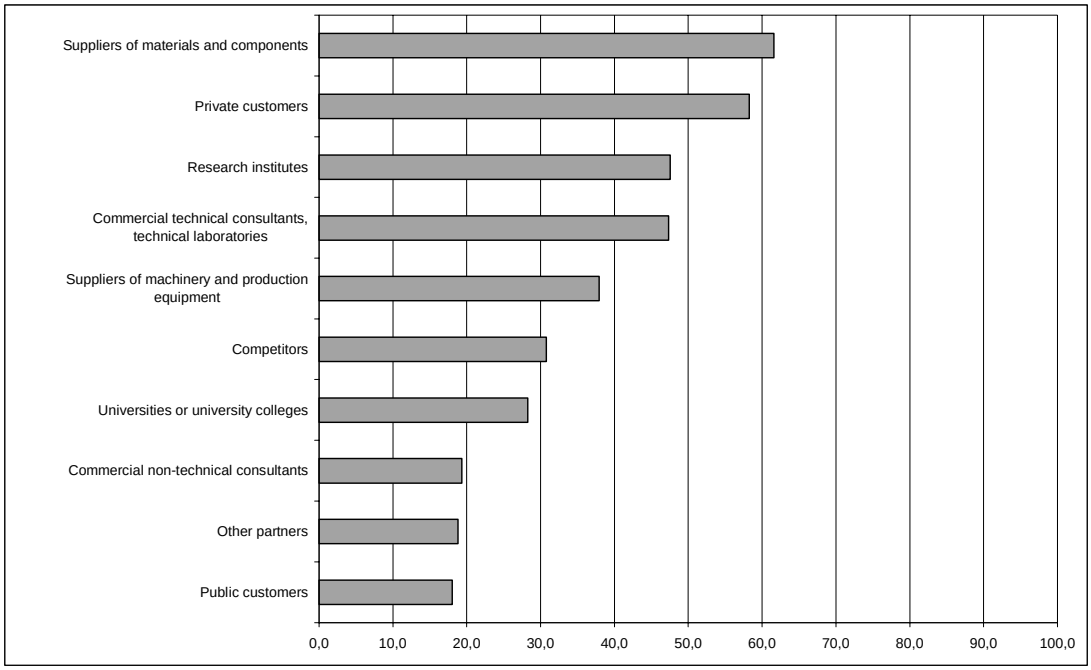
[14] The percentage of innovative firms that also reported collaboration in connection with innovation efforts.

this in part may be due to the dialogue taking part when collecting data through telephone interviews, where the definition of innovation can be discussed and more clearly understood than by mail survey.

4.2. Collaboration partners

Firms were asked to indicate what kinds of partners they had been collaborating with during the last three years. In figure 1 the partner types are listed according to the share of innovating firms reporting collaboration with each type. Suppliers of materials and components along with private customers come out as the most frequently used partner types, whereas public customers is the least frequently used partner type.

Figure 1: Share of collaborating firms that have collaborated with each partner category. 1998. Numbers are not scaled.



Suppliers of materials and equipment and private customers come out on top for all size categories (see table 6). Collaboration with the publicly supported research infrastructure however, such as research institutes and universities and colleges, is more frequent among larger companies than smaller ones. Smaller companies, on the other hand, more frequently collaborate with public customers than do larger companies.

Table 6: Collaboration partners for collaborating innovative firms, by firm size. Share of innovating and collaborating firms reporting relationship to partner type. N=393. Numbers are not scaled.

Employees	10-19 (N=69)		20-99 (N=106)		100 (N=218)	
	Num-ber	%	Num-ber	%	Num-ber	%
Private customers	37	54	67	63	125	57
Public customers	22	32	15	14	34	16
Suppliers of materials and components	37	54	59	56	146	67
Suppliers of machinery and production equipment	25	36	34	32	90	41
Competitors	16	23	30	28	75	34
Commercial technical consultants, technical laboratories	29	42	47	44	110	51
Commercial non-technical consultants	12	17	19	18	45	21
Research institutes	22	32	43	41	122	56
Universities or university colleges	12	17	24	23	75	34
Other partners	11	16	17	16	46	21

Firms were also asked to indicate the location of the partner. Part of this information is summarised in table 7, where the partner types are split between national and foreign partners. All firms collaborate more domestically, but small Norwegian firms are much more oriented towards domestic collaboration than are larger firms. In general, collaboration within a country appears to be markedly more important than collaboration with firms and other organisations in other countries.

Table 7: Collaboration partner nationality for collaborating innovative firms. Share of Norwegian / foreign partner in reported collaborative relationships. Numbers are not scaled.

Employees (N)	10-19 (N=69)		20-99 (N=106)		100 (N=218)	
Nationality	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
	%	%	%	%	%	%
Private customers	58	16	59	34	51	34
Governmental customers	32	3	15	3	17	2
Suppliers of materials and components	48	32	49	37	60	51
Suppliers of machinery and production equipment	28	26	24	20	32	32
Competitors	19	9	25	11	24	20
Commercial technical consultants, technical laboratories	41	16	45	7	48	23
Commercial non-technical consultants	19	0	19	3	20	11
Research institutes	32	4	43	9	53	17
Universities or university colleges	19	1	26	4	34	9
Other partners	13	3	13	3	13	8

The growing complexity of the knowledge base and the more rapid rate of change seems to make it attractive for most of the product-innovating firms to

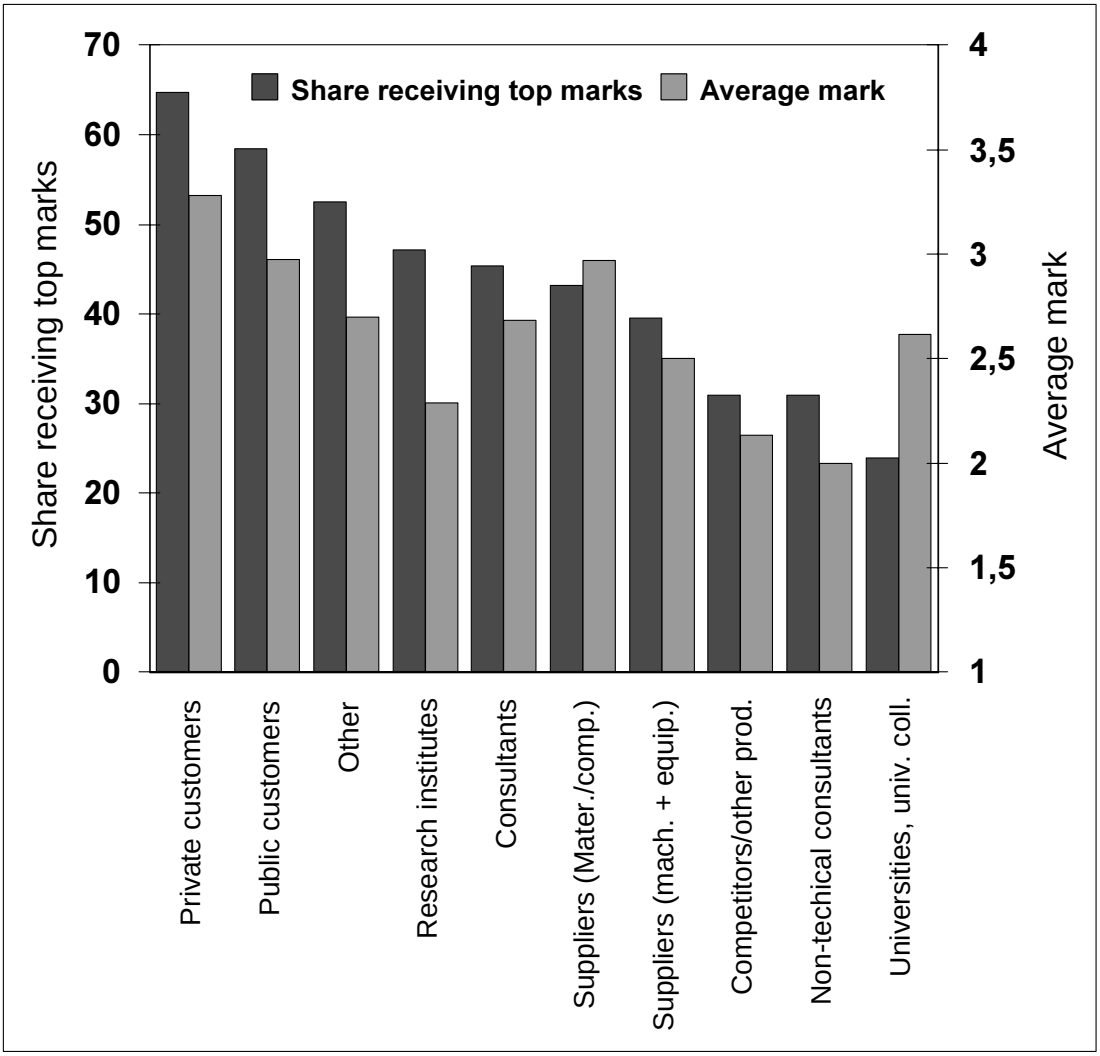
establish selective relationships which are medium- to long term. For instance, preliminary results of the Danish data reveal that of the firms having collaborated with one or several partners over the last 2 years, only a minority were collaborating with these partners for the very first time. A similar conclusion seems to hold for the Norwegian case too. In addition, more than 70% of Austrian collaborating firms fully agree that trust and confidentiality is a very important basis for collaboration. The evidence of 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 factors such as shared culture, personal experience, and individual, mutual trust.

4.3. Partners and significance of partners in most important innovation project

The survey generated a wide range of data on the "most important innovation project" for all the collaborating firms – according to their own choice of project. We asked the firms to point out what kind of partners had been involved, and to rate the importance of various partners.

It is possible and even likely that the ranking of partners based upon such evaluation of the contributions from each partner may differ from the ranking of partners according to the shares of firms that collaborate with each type. This is the case in our material, where most notably the contributions of public customers are evaluated to be of high importance to the firms – even if the number of firms involved with this type of partner is small (see figure 2 below). Private customers seems to be the partner type that contributes the most for their partner, whereas universities and university colleges ranks at the lower end also for this indicator.

Figure 2: Perceived significance of collaborating partner's contribution to innovation project. Share of reported relationships that are rated as very important (4 on scale from 1 to 4) for the innovation efforts[15]. Numbers are not scaled.



4.4. Character of collaborative relationships in most important innovation project

The Norwegian research team developed one specific set of questions that aimed at giving deeper insights into the character of collaborative relationships. How did the partners interact, and how did an innovating firm make sure that the

[15] In figure 2 it is the number of collaborative relationships with specific partner category that we use to calculate shares, and that make 100%. If all respondents in the survey which had collaboration with partner had said that the partner(s) in this category were "very important" (4 on a scale from 1 to 4), then the value here would be 100%.

The average mark is simply the arithmetic mean of the marks reported by respondents with respect to their experiences with partners in one partner category.

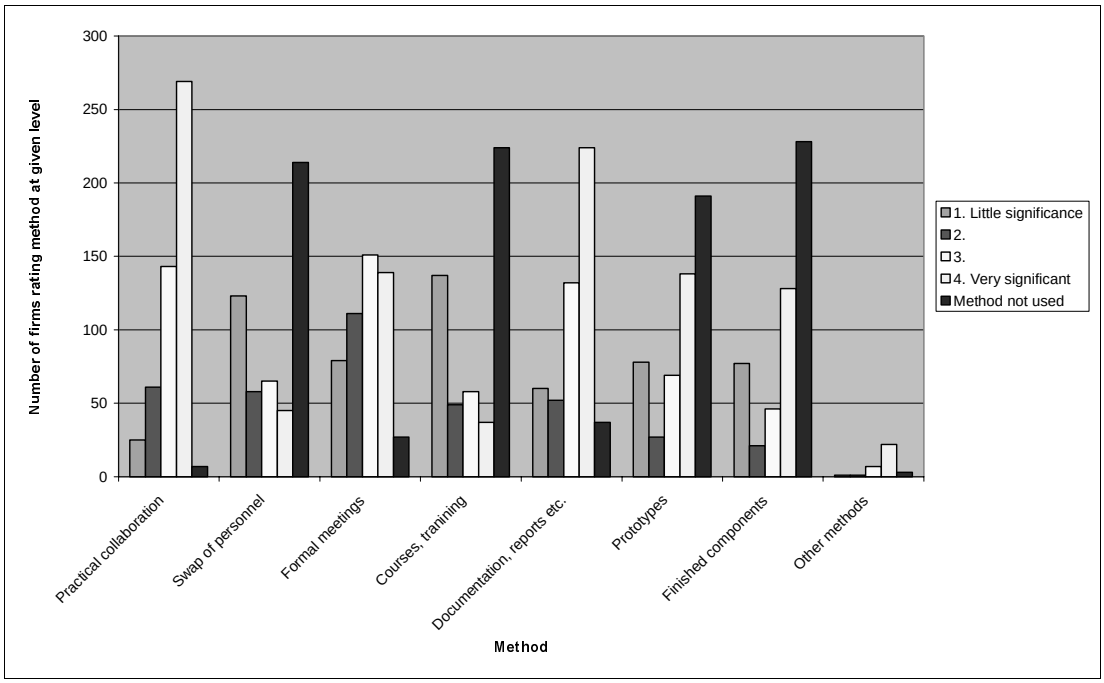
fruits of a collaboration could be "brought home"; secured for use by the firm itself, whether the collaborative efforts took place inside or outside the premises of the firm itself?

We developed a typology of collaboration *methods* and asked firms which of these they had employed in specific collaborative relationships. We also asked them to rate the significance of the different forms of interaction, and to specify to what extent formalised contracts had been signed about confidentiality, sharing of development costs or profits resulting from the innovative venture.

In figure 3 we illustrate some of the analytical possibilities by detailing the significance of methods as judged by collaborating firms. We see that several methods are considered very significant, above all practical collaboration, and documentation, reports etc. The use of the different methods also seems to be dependent upon what kind of partner that is involved.

Very few firms that have collaborated on innovation consider practical collaboration and different kinds of written documentation to be insignificant for the outcome of the innovation efforts. On the other hand, courses and training is rarely used, and is in general considered to be quite unimportant when it has been used.

Figure 3: Evaluation of transfer methods for results of collaboration. (Numbers are not scaled)



5. Conclusion

The innovation collaboration survey has generated a significant and robust dataset with interesting analytical possibilities. This working paper has only touched upon some aspects of this potential. It fills in the existing CIS and R&D surveys by focusing on the collaborative relationships involved in most innovation projects; almost three out of four innovation projects identified in this survey has been undertaken in collaboration with external partners.

The survey not only identifies collaboration, but goes on to investigate the contents and modes of operation for specific projects. Suppliers and customers are the dominating partner types, and domestic partners are far more common than foreign ones. This is less the case, however, among larger firms than among smaller ones. Even partner types that are less frequently used can be of great importance in the cases where they are present, as in the example with public customers. Furthermore, practical collaboration is considered to be a significant means of transferring information and result between the partners, along with written documentation. The use of transfer methods vary by partner type, and we expect this to be the case also when comparing firms of different types.

It should be noted that similar surveys have been undertaken in several European countries, and that this opens up possibilities for interesting comparative analysis. The STEP group is currently involved in developing new projects where the dataset can be exploited further. In particular, the comparative perspective has so far not been much developed. In addition, there are many features in the Norwegian data that can help us get a better understanding of how collaborative partnerships are organised and work. The information in the data set itself can be merged with existing data on for instance formal competencies among the employees and the innovation survey (CIS). Follow-up work also includes plans to do in-depth interviews with some of the collaborating firms and their partners.

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STEP gruppen

STEP-gruppen ble etablert i 1991 for å forsyne beslutningstakere med forskning knyttet til alle sider ved innovasjon og teknologisk endring, med særlig vekt på forholdet mellom innovasjon, økonomisk vekst og de samfunnsmessige omgivelser. Basis for gruppens arbeid er erkjennelsen av at utviklingen innen vitenskap og teknologi er fundamental for økonomisk vekst. Det gjenstår likevel mange uløste problemer omkring hvordan prosessen med vitenskapelig og teknologisk endring forløper, og hvordan denne prosessen får samfunnsmessige og økonomiske konsekvenser. Forståelse av denne prosessen er av stor betydning for utformingen og iverksettelsen av forsknings-, teknologi- og innovasjonspolitikken. Forskningen i STEP-gruppen er derfor sentrert omkring historiske, økonomiske, sosiologiske og organisatoriske spørsmål som er relevante for de brede feltene innovasjonspolitikk og økonomisk vekst.

The STEP-group was established in 1991 to support policy-makers with research on all aspects of innovation and technological change, with particular emphasis on the relationships between innovation, economic growth and the social context. The basis of the group's work is the recognition that science, technology and innovation are fundamental to economic growth; yet there remain many unresolved problems about how the processes of scientific and technological change actually occur, and about how they have social and economic impacts. Resolving such problems is central to the formation and implementation of science, technology and innovation policy. The research of the STEP group centres on historical, economic, social and organisational issues relevant for broad fields of innovation policy and economic growth.