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Research and Development in Official Statistics and Scientific Co-operation with Universities: An Empirical Investigation

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In this article we report the results of a survey of National Statistical Institutes concerning two activities: (i) Research and Development (R&D) work within an agency, and (ii) scientific co-operation of a National Statistical Institute with the universities. A prerequisite for R&D is the existence, within a statistical agency, of a certain R&D infrastructure. It includes such components as a well-documented research plan, a scientific or professional board with representation from the academic community, and funds and procedures to support scientific research by staff members. Networking is another key element. Forms of networking with universities include long-term frame contracts, joint academic posts, various fellowship schemes, and joint research projects. Our results indicate that there was large variation between National Statistical Institutes (and groups of such institutes) in the levels of R&D infrastructure and of R&D networking. A high level of infrastructure often accompanied a high level of networking. When both levels are high, the chances for a successful implementation of research results into the production of statistics are improved. The two levels are related to agency size: both tended to be higher in large National Statistical Institutes than in smaller ones. The survey was carried out in 1999-2000. The target group consisted of 52 statistical agencies around the world, covering most European countries and selected countries outside Europe. A total of 41 agencies responded to the questionnaire.

Key words: R&D infrastructure; forms of networking; university disciplines; implementing research results.

1. Introduction

In this article we report the results of a survey of National Statistical Institutes around the world about Research and Development (R&D) activities. First, we wanted to find out about activities going on within the agency itself; and, secondly, we wanted to know more about research and other scientific co-operation with universities. We concentrate on the organisation, contents and functioning of these activities.

Our motivation for undertaking this survey grew out of our interest in research in National Statistical Institutes. We took as a starting point our general knowledge of

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statistical agencies and the ways in which they operate. This background is reviewed in Section 2.

Scientific research belongs mainly in universities and other scientific communities. National Statistical Institutes, on the other hand, do not view scientific research as their main duty. However, most statistical agencies consider it an important basis for continuous quality improvement of official statistics. National Statistical Institutes define quality as a multi-dimensional concept, including such components as relevance, accuracy, timeliness, accessibility, interpretability, and coherence. Through their R&D work, statistical agencies strive to implement the results of scientific research in their statistics production. This is an important part of their effort towards continuous quality improvement.

The R&D that we consider is assumed to satisfy the definitions in the Frascati Manual (OECD 1994) – that is, it should produce new scientific knowledge or involve new applications of existing knowledge. By R&D in Official Statistics we mean here not only in Statistical Science and Survey Methodology, but also in other sciences that have relevance for Official Statistics, such as Economics, Informatics, and Sociology.

R&D in Official Statistics is done differently in different agencies. We asked ourselves if some definite patterns exist. For example, can the character of R&D in a National Statistical Institute be ''explained'' by observable features of the country, or of the agency itself, for example, its organisation, its leadership, the degree to which employees are encouraged to pursue higher studies, and so on? Do members of a group of countries share a similar pattern? To explore these and related questions we undertook a survey of National Statistical Institutes. The survey is described and its results are reported in this article. Section 2 presents our starting point and our motivation for undertaking the survey. Section 3 discusses the selection of countries for participation in the survey and the general character of the questionnaire. Section 4 relates the main survey findings. Section 5 contains a concluding discussion.

2. Background

A suitable questionnaire is needed to approach the topic introduced in Section 1. We developed the questionnaire from our general background knowledge, as we now explain.

National Statistical Institutes have different degrees of motivation and resources for R&D. For example, Finland differs much in this regard from the Baltic States, say, or from Canada. The organisation, contents, and functioning of R&D, and therefore the results of R&D, can vary considerably between agencies.

Scientific research, and R&D work, requires specialised, highly trained personnel. This holds for Official Statistics as well. Research training, acquired in a PhD or a Master's degree programme, is usually required. In some countries, relatively few such specialists are employed in the National Statistical Institute. Sometimes, the whole country including all its universities may not have many specialists in the area.

Less populous countries tend to have smaller National Statistical Institutes, as measured by the number of employees or some similar size measure. When the total resources of the agency are limited, so is the room for its own R&D. Sometimes, required official statistics are produced in a fairly mechanical fashion, and there is little time to question

whether quality improvements could perhaps be realised at a relatively modest cost by implementing new methodology.

When the statistical agencies own resources are limited or insufficient, co-operation with universities and other scientific communities may help achieve important R&D goals. Networking is a particular form of co-operation that we describe in more detail later.

Co-operation with outside expertise can greatly stimulate the R&D effort in the National Statistical Institute. Different countries use different scenarios for co-operation and exchange between the statistical agency and the scientific communities. Some agencies have recently reported their co-operational R&D work; see, for example, Barbieri and Signore (1999) for ISTAT, Bethlehem and Pannekoek (1998) for Statistics Netherlands, Hoy and Clark (1999) for the U.S. Census Bureau and Lehtonen (1998) for Statistics Finland. Experiences from several countries are summarised in Haug et al. (1998) and European Commission (1999). The need for wider co-operation between academic and official statisticians is emphasised, for example, in Franchet and Nanopoulos (1999). Establishing and maintaining co-operation is not always straightforward; difficulties can arise in the meeting of different ''cultures,'' as pointed out by Dillman (1996) and in the accompanying discussion.

In some cases, co-operation is restricted to short-duration projects, so that the relation between the National Statistical Institute and the expert is severed once the agreed-upon task has been completed. Networking is a form of exchange where emphasis is laid on more durable forms of co-operation; see Lehtonen (1999). Such *permanent networking* is currently practised with success by a few statistical agencies. It includes features such as long-term frame contracts, joint academic posts with shared funding, different fellowship schemes allowing scientific visitors (in either direction), and master's programmes in fields relevant to official statistics. Networking is seen as a means of realising several goals: risk sharing, generating ideas, and getting results.

There are two parties to networking: the National Statistical Institute on the one hand, the scientific communities on the other. We have chosen to explore networking only from one side, the side of the National Statistical Institute. That is, we did not gather data from universities and other scientific communities to see how they view co-operation with Official Statistics and the statistical agencies. Restricting data gathering to statistical agencies was necessary for practical reasons.

Lehtonen (1999) notes that a prerequisite for successful networking is a certain pre-existing culture and infrastructure in the statistical agency. The culture and the infrastructure for R&D may be very different in different countries, and may be virtually non-existent in some countries.

Lehtonen (1998) identifies the following important components of infrastructure for R&D in a National Statistical Institute:

- a well documented research plan;
- a scientific committee or (external) advisory board;
- a spokesperson for research in top management;
- a unit specialised in statistical or other methods research;
- publication procedures, those involving a scientific journal or research report series published by the agency;

- funds and procedures to support post-graduate training in a variety of disciplines relevant to Official Statistics.

Another aspect of R&D that seems important to us, and about which there is relatively little objective information, is the degree to which the results of R&D find use and application in the National Statistical Institute. R&D results are not always easily implemented within the statistical agency. This may hold whether or not the work involves co-operation with outside expertise.

One can expect the relationship between the universities and the world of Official Statistics, as it exists in the National Statistical Institutes, to show similar patterns in many countries. Official Statistics is not a university discipline. The universities usually have few qualified teachers in the area. In contrast to areas such as Law or Business Administration, Official Statistics is generally not taught in special university programmes or faculties.

Official Statistics cuts across and borrows from several university disciplines. The execution of a survey, or an official statistics programme, requires a large number of different activities as part of the planning process, the survey operations and the analysis and publication of results, and each of these has many aspects. Several university disciplines come to bear on the total set of activities, including the already mentioned disciplines of Statistical Science, Sociology, Economics, and Computer Science. The statistical agency has, in principle, a demand for expertise in all of these areas.

Typically, even the best-equipped university Statistical Science departments show only what one may call ''a modest interest'' in Official Statistics and survey theory and practice. Also, it is clear that some of the needs for research in Official Statistics must be approached via a research tradition other than the probability-based tradition of a typical statistics department.

Although the universities have no departments or faculties for Official Statistics, there exist interested individuals whose teaching and research bring them in close contact with Official Statistics. From the National Statistical Institute's perspective, such specialists are especially valuable for co-operation or networking. Their expertise can be secured under a contract agreement, under a joint appointment between the statistical agency and the university, or in some other way.

In most countries, Official Statistics offers a relatively limited labour market. Graduates seeking a career in Official Statistics compete for relatively few job openings. Often, the only important employer in the country is the National Statistical Institute. The National Statistical Institutes need rigorously trained personnel, in particular for their R&D, but it is not evident in all countries that the agency succeeds in attracting the best graduates in the sciences important to Official Statistics.

The limited number of job openings leaves rather little incentive for university departments in Statistical Science, or in other traditional university disciplines, to develop special programs catering to Official Statistics. Such programmes, usually at the Master's level, do exist in some countries (e.g., Finland, France, Indonesia, the U.S.A.). The Joint Program in Survey Methodology (JPSM) in is an example; this programme, with a mixed statistical science and behavioural science content, is run jointly by the University of Maryland, the University of Michigan and Westat Inc., and is funded primarily by the

Interagency Council on Statistical Policy. A more clear mathematical/statistical orientation is found in the University of Jyväskylä Master's Program in Statistical Systems (MPSS), funded jointly by the University of Jyväskylä and Statistics Finland. The program is described in Pahkinen and Lehtonen (2001). The importance of appropriate education and training for official statisticians is emphasised in Garonna and Geretto (1998) and U.S. Federal Committee on Statistical Methodology (1998).

With these considerations in mind, we developed the questionnaire reproduced in full in Appendix 2.

3. Methods and Data

3.1. Survey data

We selected for the survey a set of 52 statistical agencies in different countries in the world. In almost all cases, the selected agency is the one that can be described as the National Statistical Institute. That is, it is the one holding responsibility for a major share of the country's total official statistics production. In a majority of the selected countries that share exceeds two thirds.

We divided the 52 selected National Statistical Institutes into three groups. Together, two of these groups represent a nearly complete coverage of Europe, which was our principal target in this study. We refer to the two European groups as Europe-1 and Europe-2. Europe-1 was defined to consist of the statistical agencies of all European Union member states and the countries belonging to the European Free Trade Association (EFTA). There are a total of 19 statistical agencies in the Europe-1 group. Europe-2 consists of statistical agencies of most of the remaining European countries. A number of them are often referred to as transition countries, or candidate countries – that is, countries having applied for membership of the European Union. They tend to have more recent official statistics systems, perhaps with a less firmly established tradition, compared to the Europe-1 countries, and are in phases of rapid development. There are a total of 20 statistical agencies in the Europe-2 group.

We created a third group, referred to as Non-Europe. It consists of a number of statistical agencies purposively selected to cover reasonably well the other parts of the world. We considered that this group would provide an interesting reference set for comparisons with the two European groups of statistical agencies. However, since the non-European agencies selected for this survey are larger on average than the European ones, and not a representative sample, no far-reaching conclusions can be drawn about agencies outside Europe in general. All statistical agencies included in this group are institutional members of the IAOS (International Association of Official Statisticians). There are a total of 13 statistical agencies in the Non-Europe group.

Fieldwork was carried out during the period July 1999–March 2000. A completed questionnaire was obtained from 41 statistical agencies out of 52. The responding agencies in the three groups, Europe-1, Europe-2, and Non-Europe, are listed in Appendix 1.

The overall response rate was 79%, varying slightly between the groups of National Statistical Institutes (Table 1).

Table 1. The number of responding National Statistical Institutes and response rate (%) by agency group

Agency group	Number of responding agencies	Response rate (%)
Europe-1	15	79
Europe-2	15	75
Non-Europe	11	85
All	41	79

3.2. Questionnaire

The questionnaire, shown in Appendix 2, had five sections, the first of which asked for general information about the agency, including the number of employees of three types: overall, with a university degree, with an advanced university degree. The following three sections made up the core of the questionnaire:

Infrastructure of R&D. The questions in this section of the questionnaire explore the organisation, the extent and the features of existing R&D in the National Statistical Institute. Questions were asked about existing co-operation, for example, of the kind where agency staff members teach or lecture in the universities, and about any scientific journals published by the statistical agency.

Networking and similar scientific co-operation with university departments. The questions in this section solicit information about the use of outside consultants, and about the existence of professorships, based either in the university or in the National Statistical Institute, in any of the areas of relevance to Official Statistics. If they exist, we wanted to know how such positions are funded. The existence of joint research projects was also explored.

Implementation of research results. The questions in this section aim at exploring the success, or lack of it, of implementation of R&D in the National Statistical Institute. The respondents were asked to provide examples of successful implementation as well as examples of difficulties in implementation.

The concluding section of the questionnaire consisted of an Additional Comments space, allowing respondents to add any other relevant information.

Several questionnaire items focused on methods R&D. In the following, we use this term to refer to R&D activity in Statistical Science (including Survey Methodology) and/or Informatics (Information Technology, Computer Science).

4. Empirical Results

4.1. Infrastructure of R&D

We asked the agencies to specify the one, out of five alternatives, that most closely describes their current organisation of methods R&D. The results are given in Table 2.

The most common organisation type for methods R&D was a mixed-mode organisation, such that the agency has a centralised methodology unit (or several such units) as well as methods R&D decentralised to subject matter units. Of the 15 responding Europe-1 agencies, eleven reported a mixed-mode solution, while three had a centralised organisation

Table 2. Organisation of methods R&D

Organisation type	Frequency	%
Centralised	7	17
Decentralised	5	12
Mixed mode	22	54
Other arrangement[1]	5	12
No methods R&D	2	5
All	41	100

[1]For instance a separate research institute with some degree of autonomy and support from the statistical agency.

and only one a decentralised organisation. The mixed-mode R&D organisation was also the most common one in the group of 15 Europe-2 agencies, which had other arrangements, usually of an outsourcing nature, as the second most common mode. The eleven Non-Europe agencies reported the mixed-mode organisation as the most common type. Only two of the 41 responding agencies reported a complete absence of methods R&D. Thus, 39 agencies claim to be active in methods R&D.

Turning to the coverage of methods R&D, we found that all 39 agencies had R&D in Statistical Science (including Survey Methodology). Informatics (Information Technology, Computer Science) was on the program in 28 agencies. For these agencies we also asked whether Statistical Science or Informatics can be singled out as the dominant aspect of methods R&D. 18 agencies responded positively, in all cases with Statistical Science as the dominant discipline.

Moreover, R&D in Economics was covered in 28 agencies and Sociology in 15 agencies. Of the 39 agencies, eleven covered all four disciplines, Statistics, Informatics, Economics, and Sociology, and 25 covered at least three of these disciplines. Other disciplines mentioned were Anthropology, Demography, Econometrics, Geography, Public Administration, Psychology, and Environmental Accounts.

An important feature of the R&D infrastructure of a National Statistical Institute is a research plan or similar document describing the contents and goals of R&D. A total of 27 agencies reported the existence of such a document. Six of them had a published document; the others had an internal document (16 agencies) or had the document in some other format (five agencies). The publication of the research plan was most common in the Europe-1 agencies.

A scientific or professional advisory board or committee (or several such bodies) with representation from the academic community has been established in 30 of the 41 responding National Statistical Institutes. (In the following we refer to them as advisory boards.) Statistical Science was represented on the advisory boards in all 30 cases, Economics in 27 cases, Sociology in 22, and Informatics in nine. In most cases, several disciplines were represented. The most common combination was Statistics, Economics, and Sociology (13 agencies). Seven agencies had representatives of all four disciplines. Advisory boards were essentially equally common in all three agency groups. However, four Europe-1 agencies reported not having such a board.

Funding and procedures to support scientific research by staff members on specific topics of interest to the agency were provided by 16 agencies. Out of these, eleven had a formal application procedure for this purpose. Only three of the 15 Europe-1 agencies

reported having this facility (all of them Scandinavian countries), which was more commonly found elsewhere: in five out of the 15 Europe-2 agencies and in eight out of the eleven Non-Europe agencies.

We also asked whether an agency had funding and procedures to cover, in part or entirely, PhD studies of staff members and whether there is a formal application procedure for the activity. A total of 17 of 41 agencies responded positively, and a formal procedure exists in 15 of these. The facility was most often found in the Non-Europe agencies.

Some National Statistical Institutes publish a scientific journal with an external referee system, namely, 15 out of the 41 reporting agencies. The titles of these journals suggest, however, that some of them have a national scope and relevance only. A few have a wider international circulation; of these the best known are *Survey Methodology* (Statistics Canada) and *Journal of Official Statistics* (Statistics Sweden).

Teaching and lecturing in universities by agency staff, on aspects of official statistics, is a frequently found component of the R&D infrastructure in a National Statistical Institute. A total of 33 agencies reported participation in such activity, on a continuing basis or occasionally. Two-thirds of the Europe-1 agencies, 80% of the Europe-2 agencies and all of the Non-Europe agencies had this option. The activity was exercised regularly by 16 agencies. The lecturing covered topics in Statistics, Economics, Informatics, and Sociology.

To obtain a summary picture of the R&D infrastructure in a National Statistical Institute, we constructed a simple overall indicator referred to in the following as the General Index of Infrastructure (GII). It is based on the following six components:

A. Coverage of R&D: Statistical Science and at least two additional disciplines (Informatics, Economics, or Sociology),
B. Published research plan or similar document,
C. Scientific or professional advisory board or committee (or several such bodies) with representation from the academic community,
D. Funding, following formal application procedure, to support scientific research activities of National Statistical Institute staff members,
E. Funding, following formal application procedure, to support PhD studies of staff members, and
F. Regular teaching and lecturing in universities by National Statistical Institute staff members.

The presence of a component in a National Statistical Institute was scored as 1, absence as 0. The General Index of Infrastructure, GII, was computed as the sum of the six scores. The maximum GII score is thus six; the minimum score is 0. The presence of each component of GII, and the mean GII score, varied between the three agency groups in the manner shown in Table 3.

Table 3 shows that, over all the agencies, the most frequently implemented feature was that of an advisory board (Component C). Almost three-quarters of the agencies had this facility. Relatively rare facilities were a published research plan or similar document (Component B, present in only 15% of the agencies) and funding and procedures to support scientific research by staff members (Component D, with a presence of 27%).

The broadest coverage of scientific disciplines in the R&D programme was found in

Table 3. Presence (%) of different components of R&D infrastructure, and mean of the General Index of Infrastructure (GII, range 0–6), by agency group

Agency group	Freq.	Presence (%) of the GII components A to F						Mean of GII
		A	B	C	D	E	F	
Europe-1	15	67	20	73	13	33	40	2.5
Europe-2	15	40	13	73	20	20	40	2.1
Non-Europe	11	82	9	73	55	64	36	3.2
All	41	61	15	73	27	37	39	2.5

A. Coverage of R&D with respect to university disciplines
B. Published research plan or similar document
C. Scientific or professional advisory board
D. Funding of scientific research by staff members
E. Funding to support Ph.D. studies of staff members
F. Regular teaching and lecturing in universities by staff members

the Non-Europe group of agencies. Although a relatively rare activity overall, the publishing of a research plan or similar document had the highest incidence in the Europe-1 agencies. The scientific or professional advisory board was equally frequent in the three groups of agencies. Funding and procedures to support scientific research or Ph.D. studies of staff members, with a formal application procedure, was most common in the Non-Europe agencies. For Component F, teaching and lecturing in universities by agency staff, there was little difference between the three groups.

The mean of the General Index of Infrastructure, GII, varied somewhat, but not greatly, between the three groups. The lowest GII mean, 2.1, was scored by the Europe-2 agencies; the highest mean, 3.2, by the Non-Europe agencies; the Europe-1 agencies with a mean of 2.5 scored in between. The Kruskal-Wallis test indicated modest significance of differences between the three groups of agencies (exact p-value 0.064). (The test statistics that we report here and later are indicative only, since necessary assumptions in regard to random sampling, for example, are not satisfied by our survey design.)

4.2. Forms of networking with university departments

The networking of a National Statistical Institute with the scientific communities (universities; other research-oriented bodies) can take different forms. For our study, we considered that an important feature of the co-operation between an agency and the scientific communities is that the funding for the activity is assumed entirely by the agency or that it is shared in some way. We studied such important manifestations of networking as the use by the National Statistical Institute of university-based expertise, the existence of professorships and fellowships, and joint research projects. In this section, we report the results in regard to these networking activities, based on the responses from the 41 agencies.

We asked whether the agency uses university-based expertise to aid the methods R&D effort, as consultants on methodology or in other ways. 35 of the 41 agencies reported having such co-operation on a continuing basis or occasionally. All 35 agencies reported such co-operation in matters of Statistical Science, and 15 of them in Informatics. These activities were undertaken on a continuous basis in 16 agencies (four Europe-1 agencies, six Europe-2 agencies and six Non-Europe agencies).

Table 4. The number of agencies reporting the availability of a post of professor (one or more) as an arrangement of scientific co-operation with university departments, by the mode of funding

Mode of funding	Frequency	%
Type I: Funding shared by a university and the agency	10	24
Type II: Funding by a university but with some duties at the agency	8	20
Type III: Completely funded by the agency	3	7

Also we examined in detail those networking activities that involve the creation of academic posts – professorships or comparable – in support of the R&D of the National Statistical Institute. We distinguished three types of such posts: Type I: Posts with funding shared between the agency and the university; Type II: Posts funded by the university but with some duties at the agency, and Type III: Posts completely funded by the agency. The results are given in Table 4. Note that any given agency may sponsor more than one post of each type.

The scientific discipline(s) of the Type I posts included Statistical Science in nine out of the ten cases, Informatics in three cases, Economics in three cases and Sociology in one case. For the Type II posts, Sociology was included in all eight cases, Statistics in seven, Economics in three, and Informatics in two. Finally, the Type III posts included Informatics in all three cases, Sociology also in three, Statistics in two, and Economics in one case.

Type I posts were equally common in the Europe-1 agencies and the Non-Europe agencies (a third of agencies reported having such posts) but less common in Europe-2 agencies (only one agency). On the other hand, Type III posts were reported by only one Europe-1 agency, whereas four Europe-2 agencies and three Non-Europe agencies reported having this type. Type II posts were found in two Europe-1 agencies and in one Non-Europe agency.

We also asked whether the agencies had fellowship schemes funded by the National Statistical Institute to enable professors or other university researchers to spend time at the agency in order to participate in the R&D. A total of eleven agencies (four Europe-1 agencies, one Europe-2 agency and six Non-Europe agencies) out of the 41 agencies responded in the affirmative. The scientific disciplines included Statistics in ten cases, Economics in four cases, Sociology also in four cases, and Informatics in two cases.

A total of 27 of the responding 41 agencies had launched one or more joint research projects with universities, with funding provided by the agency, by a university, by the European Union, and/or in other ways. Scientific disciplines covered in these activities were Statistical Science in 20 out of 27 cases, Economics in 15, Informatics in ten and Sociology in six. This activity was most common in the Europe-1 agencies, with 13 cases out of 15. Six Europe-2 agencies and eight Non-Europe agencies reported this type of activity.

To obtain a summary picture of the networking undertaken by a National Statistical Institute, we constructed a simple overall indicator referred to in the following as the General Index of Networking (GIN). It is based on the following six components of co-operation:

a. Use of experts from university departments to contribute to the methods R&D or as consultants on methodology,
b. University professorships with funding shared by a university and the agency,

c. University professorships funded by a university but with some duties at the agency,
d. University professorships completely funded by the agency,
e. Fellowship schemes funded by the agency, and
f. Joint research projects with universities.

The presence of a component in a National Statistical Institute was scored as 1, absence as 0. The General Index of Networking, GIN, was computed as the sum of the six scores. The maximum GIN score is thus six; the minimum score is zero. The presence of each component of GIN, and the mean of GIN, varied distinctly between the three groups of agencies, in the manner detailed in Table 5.

As Table 5 shows, the most common form of co-operation, over all agencies, was the use of university-based expertise in aid of methods R&D (Component a). By contrast, university professorships funded by a university (Component c) was a very rare form.

The three groups of agencies show clear differences in their pattern of co-operation. In the Europe-1 agencies, the most popular forms of co-operation (with percentages of 80 or over) were joint research projects (Component f) and the use of university-based experts (Component a), while the least popular forms (with percentages of 20 or less) were university professorships completely funded by a university (Component c) or by the agency (Component d). In the Europe-2 agencies, the most common form of co-operation was the use of university-based experts (Component a). Very rare forms were jointly funded professorships (Component b), university-funded professorships (Component c) and fellowship schemes (Component e). All of the Non-Europe agencies reported having Component a, and the least common in this group was Component c.

The three groups thus differ substantially, and this is also clearly reflected in the mean of the General Index of Networking, GIN. The highest GIN mean, 3.0, was scored by the Non-Europe agencies, followed by the Europe-1 agencies at 2.5, whereas the Europe-2 agencies scored much lower at 1.6. The Kruskal-Wallis test showed strong significance in the differences between the three groups of agencies (exact p-value 0.007).

A total of 16 agencies also reported various other arrangements and funding schemes to facilitate an exchange of research expertise between the agency and the universities. Examples include: Contractual and agreement-based arrangements, joint sponsorship of

Table 5. Presence (%) of different components of co-operation, and mean of the General Index of Networking (GIN, range 0–6), by agency group

Agency group	Freq.	Presence (%) of the GIN components a to f						Mean of GIN
		a	b	c	d	e	f	
Europe-1	15	80	33	13	7	27	87	2.5
Europe-2	15	80	7	0	27	7	40	1.6
Non-Europe	11	100	36	9	27	55	73	3.0
All	41	85	24	7	20	27	66	2.3

a. Use of university expertise in methods R&D or as consultants
b. University professorships with shared funding
c. University professorships funded by the university
d. University professorships funded by the agency
e. Fellowship schemes funded by the agency
f. Joint research projects with universities

PhD students, co-operational student programmes (for undergraduate students), internship programmes (for postgraduate students), visiting professors, grant-aided university researchers, part-time professorships, and guest lecturing at the National Statistical Institute.

Other types of co-operative scientific activities with university departments were reported by ten agencies. These activities included textbook publishing for university teaching, organisation of training courses, and joint organisation of conferences of common interest, just to mention a few examples.

We also asked about the difficulties possibly encountered in programmes of co-operation between a National Statistical Institute and a university department. Out of the 33 agencies that responded to this question, ten reported difficulties attributed to cultural differences between the Official Statistics community and the scientific communities in the universities. Ten agencies pointed to difficulties related to a lack of responsiveness and/or interest on the part of the scientific communities. Finally, ten agencies blamed such difficulties on a lack of responsiveness and/or interest on the part of the Official Statistics community. The 33 agencies were roughly evenly distributed among the three groups of agencies.

Nine agencies reported having at least two of the three types of problem in co-operation. Four agencies had experienced all three types of co-operation problem. A few agencies cited other types of problems in co-operation; these were most often tied to a lack of funding.

4.3. The association between infrastructure and networking

To study the relationship between the intensity of networking and the advancement of R&D infrastructure, we first placed the statistical agencies into three groups based on their score on the General Index of Infrastructure, GII: agencies with low, medium, or high GII score. Note that the grouping indicates relative differences between agencies. There were four Europe-1 agencies in the high GII group and three in the low GII group. Most of the Europe-2 agencies fell into the medium GII group, and most of the Non-Europe agencies fell into the high GII group. For each GII group, we then computed the mean of the General Index of Networking, GIN. The results are shown in Table 6.

A clear association emerges from Table 6 between the intensity of networking with universities and the level of the R&D infrastructure. The GIN mean increases distinctly with the level of the General Index of Infrastructure, GII. The difference between the two extreme groups is substantial. The strength of the association is confirmed by calculating

Table 6. Mean of the General Index of Networking (GIN, range 0–6) by the General Index of Infrastructure (GII, range 0–6)

Rank of General Index of Infrastructure (GII)	Frequency	Mean of General Index of Networking (GIN)
Low	9	1.4
Medium	20	2.1
High	12	3.3
All	41	2.3

Table 7. Distribution of National Statistical Institutes by agency group according to the score on the General Index of Infrastructure (GII, range 0–6) and the score on the General Index of Networking (GIN, range 0–6)

Agency group	Frequency	Rank of GII			Rank of GIN		
		Low	Medium	High	Low	Medium	High
Europe-1	15	3	8	4	4	4	7
Europe-2	15	4	10	1	7	4	4
Non-Europe	11	2	2	7	0	2	9
All	41	9	20	12	11	10	20

association statistics: the Spearman rank correlation between GII and GIN is 0.66, which is significant at the 0.1% level.

Finally, we describe in more detail the regional differences in the score on the two indices, the General Index of Infrastructure, GII, and the General Index of Networking, GIN. We classified the responding statistical agencies into three possible groups based on the score on the General Index of Networking, GIN. This was done in much the same way as in the case of the General Index of Infrastructure, GII. In Table 7, each of the three agency groups is broken down according to the level (Low, Medium, High) of the score on the two indices. Table 7 confirms the results presented in Sections 4.1 and 4.2: there are clear differences between the Europe-1 and the Europe-2 agencies, and also between the European agencies and the Non-Europe group.

4.4. Does size matter?

To explore whether the size of the agency is associated with the level of infrastructure or with the level of networking, we started by arranging the 41 statistical agencies into three roughly equal sized groups based on the number of full-time (permanent and temporary) staff (excluding interviewers). We refer to these size classes as Small, Medium-sized, and Large agencies, respectively. Again, they reflect relative differences. Most of the Europe-1 agencies were in the Medium-sized group, most of the Europe-2 agencies were in the Small group, and most of the Non-Europe agencies were in the Large group.

For each size group, we then calculated the mean of the General Index of Infrastructure, GII, and of the General Index of Networking, GIN. The results are shown in Table 8.

Table 8 suggests that the level of R&D infrastructure, measured by the GII, is similar in the Small and Medium-sized groups, whereas a clear difference is noted between these groups and the Large group. On the other hand, the intensity of networking, measured by the GIN, increases smoothly with increasing size.

Table 8. Mean of the General Index of Infrastructure (GII, range 0–6) and the General Index of Networking (GIN, range 0–6) by agency size group

Agency size group	Frequency	Mean GII	Mean GIN
Small	13	2.2	2.3
Medium-sized	14	2.0	2.5
Large	14	3.3	2.8
All	41	2.5	2.3

We confirmed the strength of the association by the calculation of association statistics. The Spearman rank correlation between agency size and the General Index of Infrastructure, GII, is 0.35 (significant at the 5% level), and the Spearman rank correlation between size and the General Index of Networking, GIN, is 0.45 (significant at the 1% level).

4.5. Implementation of research results into the production of statistics

We found it encouraging that many agencies had undertaken successful implementation of research results in their statistics production. By implementation we mean here that that research results are made operational and become incorporated into the agency's statistics production process. Out of 40 agencies responding to this item, 28 reported successful implementation; nine reported an absence of successful implementation, while three reported no experience in regard to implementation of research.

There was a strong association of successful implementation with the scores in the General Index of Infrastructure, GII, and the General Index of Networking, GIN (Table 9).

Table 9 suggests a higher tendency towards successful implementation of research in those agencies that maintain a well-developed R&D infrastructure, as measured by the General Index of Infrastructure, GII. Even more striking is that the absence of successful implementation seems to be accompanied by a low score on the General Index of Networking, GIN. The Wilcoxon test indicated no significance for GII scores, but for GIN scores the difference between the two groups was significant (exact p-value 0.004).

Some agencies also reported other difficulties in the implementation of research results. A difficulty cited by a total of 14 out of 34 agencies was differences between the ''production culture'' and the ''research culture'' within the agency. The same number of agencies reported lack of responsiveness and/or interest on the part of the ''production culture'' as a source of difficulties. Finally, six agencies experienced difficulties due to the lack of responsiveness and/or interest on the part of the ''research culture'' within the agency. Four agencies mentioned encountering all three types of difficulties in their implementation of research results into practice.

5. Summary and Discussion

In this concluding section, we discuss a number of issues arising from our survey results.

Differences between European and non-European National Statistical Institutes. We found clear differences between European and non-European National Statistical Institutes in regard to both the infrastructure for R&D and the networking for R&D. (Our conclusions are highly tentative in view of the restricted coverage of non-European agencies.) In regard to infrastructure, the European agencies, including both Europe-1

Table 9. Mean of the General Index of Infrastructure (GII, range 0–6) and the General Index of Networking (GIN, range 0–6) by successfulness of the implementation of the results of scientific research into statistics production

Successfulness of implementation	Frequency	Mean GII	Mean GIN
Successful	28	2.7	2.6
No success or no experiences	12	2.1	1.4
All	40	2.5	2.3

(European Union member states and countries in the European Free Trade Association) and Europe-2 (other countries in Europe), tended to be somewhat weaker than the Non-Europe group. The difference can be explained in part by the fact that the Non-Europe agencies selected for our survey tended to be larger than the European agencies, and we had noted that the level of infrastructure tends to increase with agency size. The European agencies showed relative strength only in the following components of infrastructure: publishing of research plans and teaching and lecturing in universities by agency staff. The Non-Europe agencies showed relative strength in several respects: coverage of R&D, funding to support scientific research of staff members and funding to support PhD studies of staff members. In regard to networking, the non-European agencies also tended to score higher than the European agencies. As with the R&D infrastructure, this difference can perhaps also be attributed to differences in agency size. All three groups used university expertise both to aid the methods R&D and for consultation on methodology. Agencies in the Europe-1 group were relatively strong, especially in the launching of joint research projects with universities. Arrangements for professorships and fellowships were most common in the Non-Europe group and least common in the Europe-2 group.

''Critical mass'' for R&D. One can surmise that it takes a certain critical mass in order for an agency to be successful in a scientific effort and in networking, in any of the scientific disciplines relevant to official statistics. By ''critical mass'' we mean a sufficient number of scientifically competent staff within the agency. Critical mass is indicated by one of the items on our questionnaire, namely the number of staff members with a doctor's degree in the disciplines in question. We found that this number correlates positively with the level of R&D infrastructure, as measured by the General Index of Infrastructure, GII, and with the level of networking, as measured by the General Index of Networking, GIN. The average number of individuals with a PhD per agency was about 30. In the high GII group, this figure was over 50 and in the low GII group about six. Comparing the high and low GIN groups, the tendency was similar. Of the 1,000 doctor's degrees reported by the responding agencies, 840 are held by individuals employed in the high GIN group of agencies. The number of individuals with a PhD is clearly related to agency size: in the group of large agencies, there were on average close to 80 such individuals, contrasting with only five in the group of small agencies. Thus, larger agencies have much better prospects of achieving critical mass in one or more of the disciplines, as compared to smaller agencies.

Greater need for networking in smaller National Statistical Institutes? At the outset, we thought that co-operation in R&D is more urgently needed in the smaller National Statistical Institutes (the smaller countries) than in the larger agencies, so that our survey would show a higher intensity of networking in the smaller agencies. We believed that larger agencies are to a considerable degree self-sufficient and have less need for networking. These expectations turned out not to be confirmed. We found instead that the larger agencies also have well-developed networking. An explanation may be that their usually better infrastructure for R&D induces a broader basis for networking, which leads in turn to considerable networking activity. Fellegi and Wolfson (1999) discuss aspects of the need for a large statistical agency (Statistics Canada) to collaborate, in particular with the social science community. Nevertheless, one can speculate that the payoff from co-operation can be relatively more important in the smaller agencies, in the sense

that networking may bring more decisive, more significant steps towards improved quality. This view has inspired the approach of Statistics Finland, which is a medium-sized agency with about 1,000 staff, see Statistics Finland (2000).

Scientific coverage of R&D. We were somewhat surprised to find a considerable variety in the scientific disciplines covered by R&D in the responding National Statistical Institutes. In addition to Statistical Science, fields reported by many agencies as an object of R&D activities were Economics, Informatics, and Sociology. This was particularly striking in the Europe-1 and the Non-Europe agencies. This may reflect the fact that, in addition to good methodological quality, many agencies also emphasise the importance of high relevance of the statistics produced. Research in subject-matter disciplines, such as Economics and Sociology, can indeed have a positive effect on relevance.

Scientific advisory boards. We were surprised to find that so many agencies, close to three quarters in each of the three agency groups, have established a scientific advisory board or a similar body, composed of experts from outside the agency. It is likely to be a fairly recent initiative on the part of a number of countries, as perhaps on the part of several of the Europe-2 agencies. Several of these countries have a relatively young statistical agency, and the construction of a statistical infrastructure in general, and of an R&D infrastructure in particular, is relatively recent; increasingly, they are in the process of building networking activities. In such initial phases, the launching of a scientific advisory board can be an efficient catalyst.

Published research plan. The publication of a research plan or similar document appeared to be quite rare. In our opinion, an actual publication (in contrast to an informal internal document) is important for at least two reasons: (i) it informs other research communities of the R&D plans of the National Statistical Institute, and (ii) it shows a commitment of the agency to proceed with R&D, and show results, in the listed areas. An example of a published research plan is the document published by Statistics Finland (2000). Recently, some agencies have taken the initiative of announcing their R&D on a web site, as is the case for example for the Office for National Statistics in the United Kingdom and the Federal Statistical Office Germany.

Appendix 1

National Statistical Institutes included in the survey data, by agency group.

Europe-1 agencies

Austria: Statistics Austria
Belgium: National Institute of Statistics (NIS-INS)
Denmark: Statistics Denmark
Finland: Statistics Finland
France: The National Institute of Statistics and Economic Studies (INSEE)
Germany: Federal Statistical Office Germany (DESTATIS)
Greece: National Statistical Service of Greece (NSSG)
Ireland: Central Statistics Office Ireland (CSO)
Italy: National Statistical Institute (ISTAT)
Norway: Statistics Norway (SSB)

Spain: National Statistical Institute (INE)
Sweden: Statistics Sweden (SCB)
Switzerland: Swiss Federal Statistical Office (SFSO)
The Netherlands: Statistics Netherlands (CBS)
United Kingdom: Office for National Statistics (ONS)

Europe-2 agencies

Belarus, Republic of: Ministry of Statistics and Analysis (Minstat)
Croatia, Republic of: Croatian Bureau of Statistics
Cyprus: The Statistical Service of Cyprus (CYSTAT)
Czech Republic: Czech Statistical Office (CZSO)
Estonia, Republic of: Statistical Office of Estonia (ESA)
Latvia, Republic of: Central Statistical Bureau of Latvia
Lithuania, Republic of: Statistics Lithuania (LS)
Macedonia, Former Yugoslav Republic of: State Statistical Office of the Republic of Macedonia
Moldova, Republic of: The Department for Statistical and Sociological Research
Poland, Republic of: Central Statistical Office
Romania: National Institute of Statistics
Slovak Republic: Statistical Office of the Slovak Republic
Slovenia, Republic of: Statistical Office of the Republic of Slovenia
Turkey: State Institute of Statistics (SIS)
Yugoslavia, Federal Republic of: Federal Statistical Office

Non-Europe agencies

Australia: Australian Bureau of Statistics (ABS)
Brazil: Brazilian Institute of Geography and Statistics (IBGE)
Canada: Statistics Canada
China, People's Republic of: National Bureau of Statistics
Israel: Central Bureau of Statistics
Japan: Statistics Bureau & Statistics Center
Korea, Republic of: Korea National Statistical Office
Mexico: National Institute of Statistical and Geographic Information (INEGI)
New Zealand: Statistics New Zealand
United States: U. S. Bureau of Labor Statistics (BLS)
United States: U. S. Census Bureau

Appendix 2

Survey for National Statistical Agencies about:
Research and development in official statistics within the agency and
Research and other scientific cooperation with universities
QUESTIONNAIRE

1. The official name of the National Statistical Agency:
2. Respondent's name:

3. Affiliation:
4. Date:
5. Contact information for the respondent:

Please answer as completely as possible the following questions.

Part A. General background information about the agency

A1. *What is the current total number of staff in the agency*? _____ persons
Please include full-time permanent staff and temporary staff but exclude interviewers.

A2. *What is the current number of persons in the agency holding an academic degree*? _____ persons

A3. *What is the current number of persons in the agency holding a Ph.D. degree*? _____ persons

A4. *What* (estimated) *share of the country's total official statistics production is the responsibility of the agency?* _____ *%*
If available, share of expenditures may be used as a measure.

Part B. Agency's infrastructure for R&D activities

B1. *Which of the following alternatives best describes the organization of methods R&D in your agency*?
''Methods R&D'' should be interpreted to include survey methodology (covering the whole survey process), statistical methods more generally, and informatics (information technology, computer sciences). If possible, specify one alternative only.

1. Centralized methodology unit, or several such units ~
2. Methods R&D decentralized to subject matter units, without a centralized methodology unit ~
3. Centralized methodology unit or units, as well as decentralized methods R&D ~
4. A separate research institute with some degree of autonomy and support from the statistical agency ~
5. No methods R&D activity ~

B1.1. If none of the alternatives 1 to 4 fits your agency well, please describe briefly the organization of the methods R&D activity.

B2. *If there is at least some methods R&D activity in the agency* (i.e., if you answered 1,2,3 or 4 in B1), *what is the coverage of such activities*? They cover:

	Yes	No
a) Statistical science, including survey methodology	~	~
b) Informatics (Information technology, Computer sciences)	~	~

B2.1. *If both a) and b) are covered, can one of the two methods R&D activities be said to be the dominating one in the agency*? Yes ~ No ~

B2.2. *If yes, which one*?

1. Statistical science, including survey methodology ~
2. Informatics (Information technology, Computer sciences) ~

B3. *In which other disciplines, if any, does your agency engage in R&D activity*?

	Yes	No
a) Economics	~	~
b) Sociology	~	~
c) Other social sciences, please specify:		

B4. *Does your agency have one or more scientific or professional advisory boards or committees with representation from the academic community*?

	Yes	No
	~	~

B4.1. *If yes, what are the academic disciplines represented on these boards or committees*?

	Yes	No
a) Statistical science	~	~
b) Informatics	~	~
c) Economics	~	~
d) Sociology	~	~
e) Other social sciences	~	~

B5. *Does your agency have funding and procedures to support scientific research by staff members on specified topics of interest to the agency, e.g., by granting a staff member leave of absence from normal duties for a limited period*?

	Yes	No
	~	~

B5.1. *If yes, is there a formal application procedure for this activity*?

	Yes	No
	~	~

B6. *Does your agency have funding and procedures to cover, in part or entirely, Ph. D. studies of staff members*?

	Yes	No
	~	~

B6.1. *If yes, is there a formal application procedure for this activity*?

	Yes	No
	~	~

B7. *Does your agency have cooperation with universities of the type where agency staff members are engaged in teaching and/or lecturing* (e.g., in a university Master's program) *on important aspects of official statistics*?

1. Yes, on a continuous basis ~
2. Yes, occasionally ~
3. No, not at all ~

B7.1. *If yes, what are the disciplines covered by the teaching and/or lecturing activities*?

	Yes	No
a) Statistical science	~	~
b) Informatics	~	~

c) Economics ~ ~
d) Sociology ~ ~
e) Other social sciences ~ ~

B8. *Does your agency have a research plan or similar document which describes the contents and goals of research and development activities in important areas of official statistics*? Yes ~ No ~

B8.1. *If yes, what is the publication format of the document*?

1. Internal document ~
2. Published in a publication series of the agency ~
3. Other format, please specify:

B9. *Does your agency publish one or more scientific journals with an external referee system*? *Yes* ~ *No* ~
Please include journals oriented toward statistical science, informatics, economics, sociology, or other social sciences.

B9.1. *If yes, what are the name(s) of the journal(s)*?

Part C. Networking and similar scientific cooperation with university departments

C1. *Does your agency use expertise from university departments to contribute to the methods R&D or as consultants on methodology*?

1. Yes, on a continuous basis ~
2. Yes, occasionally ~
3. No, not at all ~

C1.1. *If yes, what is the coverage of such activities*? Yes No

a) Statistical science, including survey methodology ~ ~
b) Informatics (Information technology, Computer sciences) ~ ~

C2. *Which of the following arrangements are currently used in your agency for scientific cooperation with university departments*?

a) University professorships with funding shared by a university and the statistical agency Yes ~ No ~

C2.1. *If yes, how many*? ____ professorships

C2.2. *What are the academic disciplines involved*? Yes No

a) Statistical science ~ ~
b) Informatics ~ ~
c) Economics ~ ~
d) Sociology ~ ~
e) Other social sciences ~ ~

b) University professorships completely funded by the statistical agency — Yes ~ No ~

C2.3. *If yes, how many*? _____ professorships

C2.4. *What are the academic disciplines involved*? Yes No

a) Statistical science ~ ~
b) Informatics ~ ~
c) Economics ~ ~
d) Sociology ~ ~
e) Other social sciences ~ ~

c) University professorships funded by a university but with some duties at the statistical agency — Yes ~ No ~

C2.5. *If yes, how many*? ____ professorships

C2.6. *What are the academic disciplines involved*? Yes No

a) Statistical science ~ ~
b) Informatics ~ ~
c) Economics ~ ~
d) Sociology ~ ~
e) Other social sciences ~ ~

d) Fellowship schemes funded by the statistical agency whereby professors or other university researchers spend time at the agency in order to participate in the research activity — Yes ~ No ~

C2.7. *If yes, how many*? ____ fellowships

C2.8. *What are the academic disciplines involved*? Yes No

a) Statistical science ~ ~
b) Informatics ~ ~
c) Economics ~ ~
d) Sociology ~ ~
e) Other social sciences ~ ~

C3. *Are there other arrangements and funding schemes* (than those in C2) *used to facilitate exchange of research expertise between the agency and the universities?* Yes ~ No ~

C3.1. If yes, please describe briefly:

C4. *Does your agency have joint research projects with universities financed by the statistical agency, by a university, by the EU, and/or by some other funding source?* Yes ~ No ~

C4.1. *If yes, what are the academic disciplines involved*? Yes No

a) Statistical science ~ ~
b) Informatics ~ ~

c) Economics ~ ~
d) Sociology ~ ~
e) Other social sciences ~ ~

C5. *Are there cooperative scientific activities with university departments other than those covered by C1 to C4 that you wish to point out*? Yes ~ No ~

C5.1. If yes, please describe briefly:

C6. *Could you give one or more indications of difficulties encountered in programs of co-operation such as C1 to C5?*
To assist you in answering, we hint at some possibilities:

a) Difficulties due to cultural differences between the official statistics community and the scientific communities within the universities Yes ~ No ~

b) Difficulties due to lack of responsiveness and/or interest on the part of the scientific communities within the universities Yes ~ No ~

c) Difficulties due to lack of responsiveness and/or interest on the part of the official statistics community Yes ~ No ~

d) Difficulties due to other reasons, please specify:

Part D. Implementation of research results

D1. *Are there recent examples of successful implementation of results of scientific research in your statistics production processes*? Yes ~ No ~ No such activities ~
We mean by ''implementation'' that research results are made operational and become incorporated into the agency's statistics production.

If yes, please list some of the statistics production processes:

D2. *Could you give one or more examples of difficulties experienced by your agency in implementing (with or without success) the results of scientific research*?
To assist you in answering, we again hint at some possibilities:

a) Cultural differences between the ''production culture'' and the ''research culture'' within the agency Yes ~ No ~

b) Lack of responsiveness and/or interest on the part of the ''production culture'' Yes ~ No ~

c) Lack of responsiveness and/or interest on the part of the ''research culture'' Yes ~ No ~

d) Other reasons; please specify:

Part E. Additional comments

Please give the additional comments you would like to point out concerning the R&D activities in your agency and the cooperation with university departments, and the possible special features of these activities in your agency:

THANK YOU FOR YOUR COOPERATION

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