

Nordic Collaboration Scrutinized

A long history and the tradition of closely-knit cultural, political and economic interaction between the five Nordic countries has led to an extensive network of more or less institutionalized cooperation arrangements within the cultural, educational and scientific sectors. They exist between all Nordic universities, between national research councils and between a large number of private associations and companies. Industry also collaborates at the R&D level so the result is scientific and industrial cooperation in numerous areas, forms and institutional settings ranging from bilateral arrangements to Nordic programmes and institutions. The Directors of three Nordic institutions concerned with different aspects of research describe how cooperation works and the repercussions of adherence to the European Union by some of the countries is having on collaboration.

THEORETICAL PHYSICS

Paul Hoyer

Director, Nordic Institute for Theoretical Physics, Stockholm

The beginning of the year brought important changes to the political affiliations of some of the Nordic countries because Finland and Sweden joined Denmark in the European Union (EU). The Norwegians, on the other hand, opted in their referendum last autumn to remain outside the EU, together with the Icelanders. The new configuration is having some repercussions on the close collaboration built up between the Nordic countries since World War II. The outcome will interest physicists since there is extensive Nordic collaboration in physics, which is nurtured in particular by Nordita, the Nordic Institute for Theoretical Physics based in Copenhagen.

An Established Infrastructure

There exists a well-developed institutional framework for Nordic collaboration. The *Nordic Council*, which held its first session in 1952, is a parliamentary body with 87 voting members. Delegates are appointed by the national parliaments of the five member states (Denmark, Finland, Iceland, Norway, and Sweden) and by the local parliaments of the three autonomous regions (the Faroe and Åland islands, and Greenland). It runs several permanent institutes for research and a number of more or less permanent programmes, institutions, etc. related to cultural, educational, scientific and economic activities. The *Nordic Council of Ministers*

Nordita, Stockholm.

The main Nordita building is on the left.



is an executive body serving the Nordic governments. The Secretariat of the Council in Copenhagen is headed by a Secretary General and has about 100 employees.

Among the significant achievements of Nordic collaboration is the creation of a common labour market (since 1954) and a social security system. All Nordic citizens can move, work and receive social benefits in the entire region without any formalities such as passports or work permits.

The annual budget for Nordic cooperation is about 700 MDKR (1 DKR = 1 Danish krone ≈ 0.13 ECU), of which roughly 30% is earmarked for education and research. There is a Nordic research funding agency, the *Nordic Academy for Advanced Study* (NorFA), which supports Nordic summer schools and symposia, research networks and graduate education. The *Nordplus* scheme funds inter-Nordic student and teacher exchanges at the undergraduate level, and is thus the Nordic equivalent of the European Union's SOCRATES programme. There is even Nordplus Jr. aimed at increasing the mobility of 16-19 year old students.

A Prestigious Centre

The Nordic countries are large in area but small in population — the total number of inhabitants is less than 24 million, comparable to that of a medium-sized European country. Many of the research groups in theoretical physics are rather small and widely spread, geographically speaking. This calls for special efforts to develop contacts and cooperation. Fortunately, the Nordic countries form a culturally homogeneous and unit which is large enough to make collaboration fruitful in practice. Nordita is the oldest and largest of the research institutes operated by the Nordic Council of Ministers. It stimulates contacts and helps bring new research topics and experts

into the Nordic region, while its centre in Copenhagen serves as an advanced training ground for young Nordic physicists.

The establishment of Nordita was in fact closely linked to that of CERN. Owing largely to the influence of Niels Bohr, the CERN theory group was placed in Copenhagen when the decision to build CERN was taken in 1952. Some years later, when it was decided that the theory group would move from Copenhagen to Geneva, Torsten Gustafson (Lund), Niels Bohr and other prominent Nordic physicists took the initiative to establish a Nordic centre for theoretical physics in Copenhagen. The idea was well received at the political level: theoretical physics was a uncontroversial, relatively inexpensive area of collaboration, and the other Nordic countries stood to benefit from the eminent research group in Copenhagen. An important activity of the new institute was to be the training of young Nordic researchers in postdoctoral ("stipendiate") positions.

Nordita started operating on 1 October 1957 and can point today to an impressive list of former stipendiates who moved on to prominent positions in Nordic universities. With an annual operating budget of 17 MDKR, the institute has six tenured professors, six adjunct professors, four assistant professors, and about 14 Nordic postdoctoral positions. There is also an extensive visitor and symposium programme. Research topics covered include theoretical astrophysics, condensed matter, and high energy and nuclear physics; cross-disciplinarity is encouraged. The institute is located on the premises of the Niels Bohr Institute adjacent to the recently established Danish Theoretical Astrophysics Center. Scientific research at the three centres is closely interrelated.

As Nordita is a multinational institute it has special obligations towards physics in the Nordic area. This is reflected in its administrative structure, which has a number of special features. The institute is governed by a Board, that makes most of the long-term decisions. Each member state contributes two Board members, who are active physicists. The Nordita Director and Faculty are responsible for the daily running of the institute. To further strengthen the Nordic input, each of the main research areas has a Nordic advisory committee which makes recommendations on Nordita's stipendiate appointments and other matters of common interest.

Collaboration to Remain a Priority

At its meeting in Reykjavik on 27 February to 2 March 1995, the Nordic Council debated the future perspectives of Nordic collaboration, given that a majority of the member states now belongs to the EU. A programme for streamlining the political decision making procedures was adopted in principle. Collaboration in the areas of culture, education and research will remain an

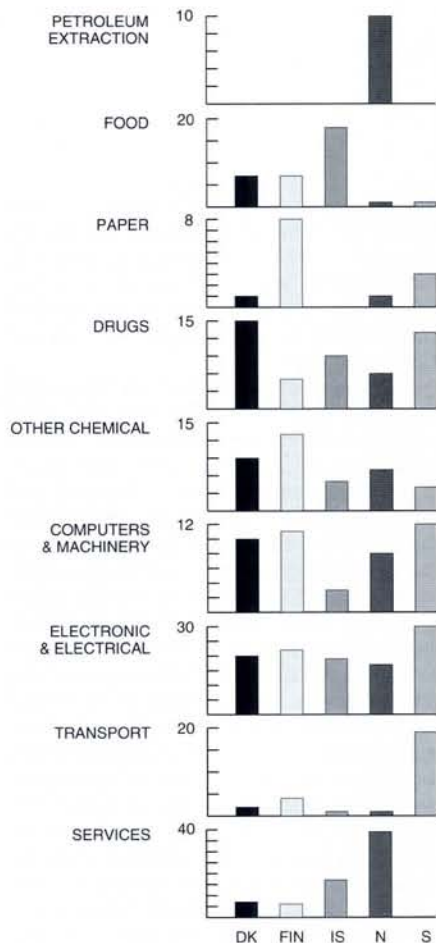
Nordic industrial R&D spending: total R&D in the business enterprise sector in 1991. Selected branches as a percentage of the total for each country (DK - Denmark; FIN - Finland; IS - Iceland; N - Norway; S - Sweden). Norway's large share of service industries can be explained by its many industrial R&D institutes; service industries in Sweden are not accounted for.

item of high priority and receives a modest budget increase in 1996. True to the trends of our times, special emphasis will be placed on the "usefulness" of all activities for the Nordic area. Fortunately, Nordita provides good value for the money in this respect as well.

Maintaining good relations with, and support of, the newly independent Baltic states will remain an area of high priority to all Nordic countries. Collaboration with the Baltic region and with north-west Russia figures prominently on the agenda for Nordic co-operation. Nordita and the Nordic universities have during the past few years increased considerably the exchange of physics students and researchers, and arranged summer schools and lecture courses involving Baltic students. To further develop the collaboration with this region, Nordita is establishing a "Nordic-Baltic" committee. With members from both the Nordic and the Baltic countries who are physicists, it will

advise the Nordita Board. The established collaborations with the well-known physics centres in the St. Petersburg area will of course continue.

Nordic governments are aware that scientific competitiveness is crucial for their nations' success and for tomorrow's welfare. Regardless of their EU membership status, all the Nordic countries participate in the EU science programmes and strive to increase their scientific collaboration with the rest of Europe. As a regional institute with a broad range of interests in physics research and excellent international connections, Nordita has a special significance. It also maintains close links with its German neighbour, the DESY laboratory in Hamburg, and welcomes possibilities for closer cooperation with other centres. European collaboration in theoretical physics will continue to increase, with Nordita having a vital role to play, especially in the northern European region.



INDUSTRIAL R&D COOPERATION

Ove Poulsen

Executive Director, Nordic Industrial Fund, Oslo

The private business sector is the main performer of research and development in the Nordic countries (51000 MSKR in 1991 where 1 SKR = 1 Swedish kronor = 0.10 ECU). Only Iceland stands out with less than 50% of total R&D spent in the private sector. In terms of R&D manpower, the percentage of total full-time equivalents (FTEs) spent in industry was about 57 percent in 1991, with above average amounts (about 60 percent) in Denmark and Sweden. Denmark, Finland and Iceland have seen a constant increase in their R&D FTEs as compared with Norway and Sweden, where they have decreased since 1987. The importance to each of the five countries of selected knowledge-based industries is clearly seen in the figure above. All devote the largest amounts of R&D resources to industries related to microelectronics. But for other fields, the distribution differs greatly between the five countries, depending on the emphasis placed on their basic industry.

Nordic R&D collaboration of industrial relevance is mainly organized at the institutional level through support of industrial R&D by the *Nordic Industrial Fund* (NIF). Founded in 1973 by the governments of the five Nordic countries, it reports to the Nordic Council of Ministers. The NIF's main objective is to strengthen the position and competitiveness of Nordic industry by stimulating technological and industrial development. The Fund does this by:

- identifying and encouraging Nordic R&D programmes and projects;
- funding Nordic R&D projects;

- stimulating the growth of technological and industrial networks.

The Fund's total grant budget amounted to 73.7 MNKR (1 NKR = 1 Norwegian kroner = 0.12 ECU) in 1994. All organizations and enterprises in the Nordic region can apply for financial support for R&D projects of industrial relevance. Applications must contain a clear statement of an enterprise's intention to collaborate with companies in at least two Nordic countries.

The NIF's executive body is a Steering Committee which is assisted by an Executive Director and a secretariat comprising about 15 professionals in technology and business. Like any other organization, the NIF has had its ups and downs. During the last decade, relatively large capital transfers to the Fund from the Nordic Council of Ministers have been necessary to meet increasing R&D and investment costs. One successful result has been the Nordic Biotechnology R&D Programme which ended in 1994 at the same time as two other R&D programmes (Industrial Environment; Materials Technology). The biotechnology programme involved around 300 scientists — full or part time — in industry and research institutions and resulted in the formation of three new biotechnology companies, some 20 patents, 30 Ph.D.s. theses, and 700 scientific articles.

Focussing on Basic Industry

In 1992, the Nordic Council of Ministers decided that the NIF would focus activities in 1993-96 on:

- new technologies in the food industry;
- new technologies in the wood and paper industries;
- lightweight structures.

Accordingly, the Fund granted 73.7 MNKR in 1994 (85.2 MNKR in 1993) to 125 technological and industrial collaboration projects in these areas through four industrial R&D programmes (*NordFood*, *NordList*, *Nordic Wood*, *NordPulp*) which are essentially co-financed by industry on a 50/50 basis. More than 1200 companies and R&D centres are participating, and each project involves an average of 3-4 Nordic countries. The projects in which the NIF participates had a total budget of 260 MNKR in 1994 (323 MNKR in 1993). Its support amounted to an average of 28%, with industry covering 49% and national R&D bodies the remainder. Research institutes and universities received the largest share of NIF's funds (70% in 1994).

Some 16% of the NIF's total grant budget was allocated in 1994 to so-called independent projects unrelated to the priority areas. This is to ensure the Fund's ability to support industrial or institutional R&D efforts that are of significance for industry but lie outside the NIF programme framework.

Nordfood, the Nordic R&D programme for the food industry, was initiated in December 1993 "to contribute to the continued competitiveness of the food industry in a changing market by ensuring that a 'critical mass' is attained in selected research areas". Of the programme's total budget of approximately 260 MNKR, NIF financed 30% and national R&D bodies 20% (industry provided the re-