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ABSTRACT

This paper describes the organization and planning for research and development in Sweden, particularly the role of higher education. A section on policies notes that the state has overall responsibility to fund basic research and the training of research workers. Issues receiving particular attention include environmental problems and new technologies. Types of institutions involved in research include the Ministry of Education and Science and its three main research councils which fund basic research. Universities, university colleges, and research institutes which train research workers are commissioned by the government to do research and at times also contract to do research for the business community. Academies enjoy an independent status as promoters of research and science in different disciplines. Private foundations also support university-based research. The level of research and development in industry is high by international standards. Discussion of long-term planning notes a current emphasis on short-term projects at the expense of long-term projects. A final section describes Sweden's involvement in international research and development particularly in cooperative efforts with other Scandinavian countries and other European research councils and institutions. (JB)

Research Planning and Organization

Fact Sheets on Sweden

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Research Planning and Organization

Fact Sheets on Sweden

Research and development are of strategic importance to Sweden's economy, employment and quality of life. Spending on research and development (R&D) currently amounts to almost 3% of the Swedish gross domestic product.

Industry accounts for the majority of R&D expenditure, with an emphasis on development-oriented projects, concentrated in certain industries and high technology companies. The demands placed on higher education establishments and on the technological level of companies are constantly growing. With an increasing proportion of Sweden's overall R&D activities financed by the business sector, it is generally acknowledged that there may be a risk that long-term research aims and basic research may lose ground.

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Policies for research and development

The State has the primary responsibility to fund basic research and the training of research workers. Research is also one of the few areas of the central government budget that have been given increased funding in recent years.

Total central government allocations for R&D in fiscal year 1990/91 amounted to SEK 16,400 million. Of these, approximately SEK 7,300 million were assigned to general scientific development, primarily university and research council funds.

The Research Bill of 1990 provided for reforms adding up to SEK 1,000 million over three years, over and above compensation for inflation. These resources are channeled primarily into the universities, with the emphasis on recruiting new generations of researchers, and to work in certain priority areas of research.

Research on environment and new technologies

Acidified lakes, polluted seas, and increasing forest dieback are among the serious problems underlying a necessity to intensify natural environmental research. Work injuries still occur at an alarming rate, despite considerable efforts in the last 20 years to reduce their number. Allocations have therefore been increased in relation to research on both the natural and urban environments and the working environment.

New basic technologies are currently being established in both industry and the service sector, affecting people's work and leisure. The industrial nations are making sizeable investments in information technology and biotechnology. The increasing emphasis on biotechnology today requires above all a strengthening of basic research in cell and molecular biology.

Sweden is participating in the European Eureka initiative and has an agreement with the European Community to broaden research cooperation. Sweden is also taking part in European space cooperation and is actively involved in the scientific cooperation being built up in the Arctic and Antarctic regions.

Total expenditure on R&D in the higher education sector by field, 1989/90, SEK million

Medicine/dentistry/pharmacy	3,637
of which, teaching hospitals	1,300
Engineering	2,679
Natural sciences	1,689
Agricultural sciences	1,226
Social sciences/law*	1,200
Humanities/theology	671
Total**	11,104

* incl. teacher education and theme research
** Figures do not add due to rounding.
Source: Statistics Sweden (SCB)

The Ministry of Education and Science and the research councils

The Ministry of Education and Science is responsible for most higher education and for three of the main research councils which fund basic research. In 1990, two new councils were set up: the Swedish Research Council for Engineering Sciences (TFR), under the Ministry of Industry and Commerce, and the Social Research Council (SFR), under the Ministry of Health and Social Affairs. The responsibility for coordination of research policy lies with the Ministry of Education and Science.

The research councils under the Ministry of Education and Science are the Council for Research in the Humanities and Social Sciences (HSFR), the Medical Research Council (MFR) and the Natural Science Research Council (NFR). A coordinating body, the Council for Planning and Coordination of Research (FRN), has also been set up. FRN is parallel to the councils and cooperates with them and with sectoral research bodies to initiate and finance joint projects in research areas of great social importance.

The research councils largely consist of scientists appointed by academic electoral assemblies, but a small number of them represent sector-oriented research bodies. In contrast, a majority of FRN members represent the public interest.

As of 1988, the Institute for Futures Studies replaced another institution in this field: this institute is a public foundation directly subordinate to the Government.

Also of research council character is the role played by the Cancer Fund and the Bank of Sweden Tercentenary Foundation. The Cancer Fund, which is backed by trade unions, political parties and non-profit associations, grants support to cancer research. Its operations are financed for the most part out of private donations. Decisions on funding by the Tercentenary Foundation are taken primarily by MPs, who are advised by a council made up of academics.

In order to promote contacts between research and the general public, FRN is responsible for the Program for Public Understanding of Science. All establishments of higher education are also responsible—according to law and statutes—to promote these contacts.

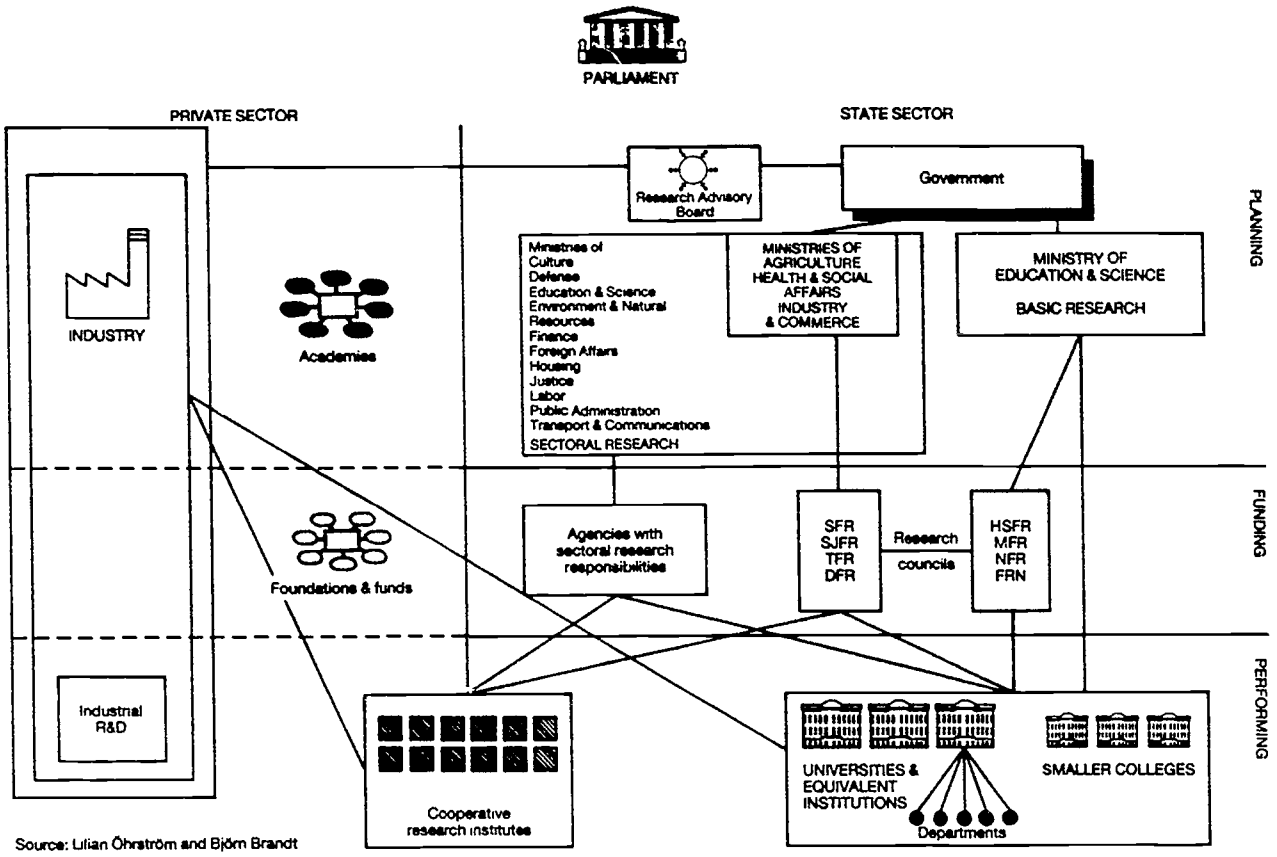
Universities, university colleges and research institutes

The organization of higher education, which in Sweden is government-financed, plays a key role in the Swedish research system, not only because the universities and university colleges form the traditional base for the training of researchers (graduate study) and long-term, interdisciplinary research of importance, but also because the universities are used as far as possible for research commissioned by official sectoral bodies and in some areas for research under contract to the business community.

Falling under the purview of the Ministry of Education and Science are the six universities in Göteborg, Linköping, Lund, Stockholm, Umeå and Uppsala. Full resources for research and graduate study are also put at the disposal of the school of medicine in Stockholm (Karolinska Institutet) and the institutes of technology in Stockholm, Göteborg and Luleå. Programs of research and graduate study are also pursued at the Stockholm School of Economics, which is a private educational establishment with state support, at certain larger teacher-training colleges and the College of Physical Education in Stockholm.

The Ministry of Agriculture is responsible for the University of Agricultural Sciences, which incorporates an agricultural college, a

The Swedish R&D system



Source: Lilian Öhrström and Björn Brandt

college of forestry and a veterinary college.

The National Board of Universities and Colleges (UHÄ), headed by the Chancellor of the Swedish Universities and Colleges, was up to July 1992 the central authority for higher education, charged with promoting compliance with the goals and guidelines defined by Parliament for higher education within the domain of the Ministry of Education and Science. It had the task of following up, evaluating and supervising activities in the higher education sector and was also responsible for admission to general study programmes. The Board has now been replaced by two new agencies: a secretariat for evaluation and quality control, and the National Agency for Higher Education (VHS), responsible for services to the universities and the general public.

It stands to reason that a substantial part of the university research is performed by the group of researchers who are enrolled in graduate study. There are about 15,000 persons in this group. It should be noted, however, that many of them have only a minor study and research activity. About 1,300 persons per year receive PhDs or similar degrees after completing graduate study, which in principle runs for four years.

There is a connection between undergraduate study and research: in principle, all education above secondary level is supposed to be based on research. Representatives of the public interest and of industry, etc. sit on the university boards.

The Swedish aspirations to draw wherever possible on the universities and university colleges in satisfying society's research needs are related to a desire to avoid creating independent, totally state-run research institutes. Even so, a number of such institutes do exist and new ones are added at infrequent intervals. Here the most notable example is the National Defense Research Institute (FOA) dating from 1945; it is the country's largest research establishment with about 900 employees.

Building research is the province of an institute located in Gävle. In Linköping there is another institute specifically devoted to transport engineering.

Studsvik AB, which is organized as a state-owned company, performs a substantial amount of R&D related to energy. Under the heading of natural sciences also fall the Manne Siegbahn Institute of Physics and the Swedish Institute of Space Physics.

In the sphere of social issues, there is the Swedish Center for Working Life, whose research is chiefly concerned with issues of social welfare policy and labor market policy.

Of special interest is the Stockholm International Peace Research Institute (SIPRI), which is independent of the Swedish government, that does no more than cover the costs of its operations. SIPRI's management and research staff are internationally recruited.

In addition, there are investigative laboratories and research departments which serve government agencies, for instance in the fields of environmental protection and food products.

Academies

In the Swedish research system the academies enjoy an independent status in their traditional role as promoters of research and science in different disciplines. They work by running their own research stations—albeit as yet on a limited scale compared with academies in several other countries, by organizing conferences and symposia, publishing periodicals, making and maintaining international contacts, and by pursuing studies and making proposals on matters of research policy.

The Royal Academy of Sciences (KVA), perhaps best known abroad for its designation of the Nobel laureates in chemistry and physics, was founded in 1739. Although its activity is largely based on private donations, KVA now receives annual government subsidies.

The Academy of Engineering Sciences (IVA) is likewise a private but state-supported organization. It also receives support from Swedish industry. Like KVA, IVA operates an extensive international contact network.

In addition to these academies there are the Royal Academy of Agriculture and Forestry and the Royal Academy of Letters, History and Antiquities.

Private foundations

There are also private research-supporting foundations. The possibility of financing research projects at universities and university colleges through grants from private foundations greatly contributes to the pluralism which marks the Swedish research system. To no small extent, moreover, equipment for university research has been donated by private foundations.

Industrial investment

Industrial investment in fixed capital rose by almost 100% between 1982 and 1989, with a reported increase of 16% in 1989 itself. After this period of growth, manufacturing industry reported a decline in investment in machinery and buildings of 5% in 1990.

R&D activity in the manufacturing sector showed a steady increase up to 1987, but fell by 7% in fixed prices up to 1989. R&D activity is still at an internationally high level. In 1989, expenditure on R&D amounted to 2.7% of industry's share of domestic product, which can be compared with 2.6% in Germany, 2.4% in the US (1987), and 2.2% in Japan (1988).

The R&D intensity varies sharply from industry to industry. This intensity is highest, indeed exceptionally high, in the pharmaceutical industry, with the manufacture of trans-

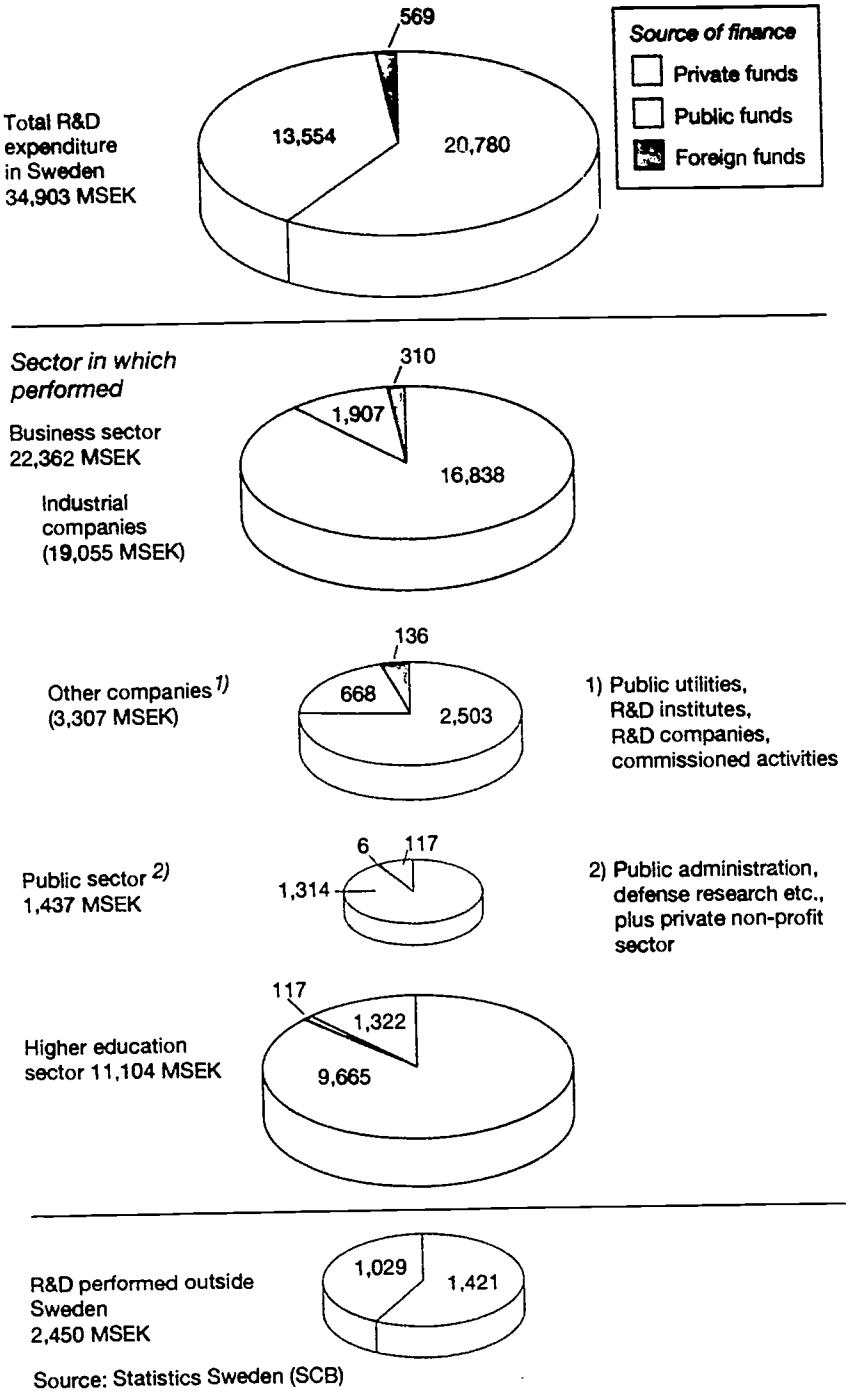
port equipment and of electrical machinery and equipment coming next. In 1989 the transport equipment industry, the electrical equipment industry, the engineering industry and the pharmaceutical industry accounted for 80% of the R&D outlays in mining and manufacturing.

As we have already seen, government R&D funds pass through three channels: the higher education system, the research councils and the sector agencies, i.e. agencies whose activities are limited to particular sectors of society.

The sector agencies have a long ancestry. For a long time now, different sectors of society have identified different research needs. The faculties, strictly speaking, are a manifestation of this. The faculties of medicine were set up to improve the state of knowledge in the medical sector. Agriculture and forestry acquired a university complete with research council. Later on, the building sector acquired the Council for Building Research and the National Institute for Building Research. In the industrial sector, several small specialized agencies were merged into one in 1968. Today, governmental support for research relevant to industry is granted via the Research Council for Engineering Sciences, while support for development is channeled through the National Board for Industrial and Technical Development (Nutek).

Today's sector research principle means that there are two parallel strands to Sweden's research policy. On the one hand, support for basic research at universities, where the main approach is to encourage the work of promising researchers, regardless of subject or emphasis; and on the other hand, support designed to build up a scientific capability in a given area. Investments in R&D in Swedish industry mainly go into development. Commercial realities force companies to concentrate on competitiveness in products and production.

Total expenditure on and funding of R&D, 1989, SEK million



Source: Statistics Sweden (SCB)

R&D funds in the central government budget, fiscal year 1991/92, according to purposes

Purpose	SEK million	Percent
General scientific development	8,479	45.6
Defense	5,020	27.0
Transport and telecommunications	1,254	6.7
Industrial activities	1,065	5.7
Physical environment, environmental protection	577	3.1
Energy and water supplies	510	2.7
Working environment, occupational health and safety	362	1.9
Agriculture, forestry, hunting and fishing	328	1.8
Space activities	304	1.6
Public administration, public services	225	1.2
Health and medical care	112	0.6
Housing environment, land-use planning	105	0.6
Culture, media, leisure	85	0.5
Education	59	0.3
Social welfare, social environment, social security	52	0.3
Research on the earth and atmosphere	49	0.3
All purposes	18,586	100.0

Source: Statistics Sweden (SCB)

Toward more long-term planning

The sector agencies represent the bulk of government R&D resources. They also represent a principle of pluralism in Swedish research policy.

In recent years, however, the effects of the short-term, project-related working approach have become a moot point. Higher education researchers are tending more and more to be engaged for a year at a time via project funding, and basic research is being kept short.

The sector agencies themselves are aware of this dilemma, and many of them have begun to work for a different planning procedure. In 1990, two new research councils were established to secure resources for long-term basic research in the fields of technology and social science. The National Environmental Protection Agency, the Council for Building Research and the Energy Research Commission are funding professorial and intermediate appointments at the universities. The Council for Building Research and the Work Environment Fund are supporting long-term research programs.

The long-term goal should be to ensure that sector agencies either make their own permanent investments in higher education or else aim to cover fully the costs connected with limited-period projects.

A somewhat different situation exists as regards defense research. Very little university-level research is being carried out in certain areas essential to defense. For this reason defense research has been given a firmer organizational structure and the emphases and quality of research are regularly reviewed in connection with defense decisions.

International R&D cooperation

Sweden accounts for roughly 1% of the world's total expenditures on R&D. Thus Sweden is extremely dependent on contacts with other countries in research matters.

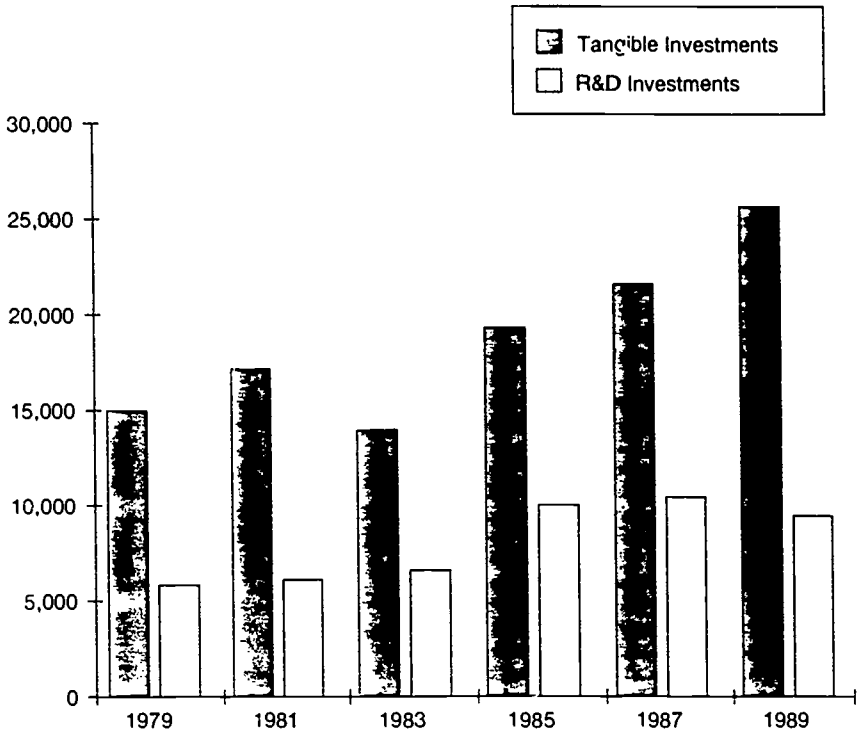
R&D cooperation between the Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) forms an important part of the endeavor to deepen the scope of Nordic cooperation in general. Here the central bodies are the Nordic Council and the Nordic Council of Ministers. There is a separate Nordic agreement on cooperation in the cultural and educational spheres. A number of research activities are financed under this agreement. By way of example there are the Nordic Institute for Theoretical Atomic Physics, the Central Institute for Nordic Research on Asia, the Joint Nordic Committee for International Politics, etc.

Sweden is also heavily committed to fostering wider international cooperation. The research councils, especially in the fields of natural science and medicine, sit on joint committees with their Western European counterparts, and the Royal Academy of Sciences as well as the Council for Planning and Coordination of Research (FRN) and all the research councils under the Ministry of Education and Science are members of the European Science Foundation formed in 1974.

Much of the organized international research teamwork takes place in joint projects or coordinated research programs. Sweden is involved in a multitude of such programs. The biggest economic commitments are participation in CERN, the European organization for nuclear research, and in ESA, the European Space Agency. Swedish involvement in the EC's R&D programs has grown considerably, e.g. in the fields of information/communication, industrial and materials technologies, the environment, energy, medicine and health, a researcher mobility program, etc. Sweden also participates in Eureka, which promotes industrial technological cooperation. Other commitments are the European Molecular Biology Laboratory (EMBL), the European Southern Observatory (ESO), the European Synchrotron Radiation Facility (ESRF), and COST, a European organization for cooperation in technical R&D. Sweden is host country for EISCAT, an international body promoting research on the upper atmosphere.

In addition to the above, a number of organizations make arrangements for the exchange of research fellows, grant scholarships for the pursuit of research abroad, exchange information about research, etc.

Tangible investments and R&D investments in the Swedish manufacturing industri, 1979-89, in SEK million, 1980 prices



SEK 1 = USD 0.19 or GBP 0.10 (approximately)

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