# Science and Technology Indicators

2004 NORWAY

NIFU

# Introduction

This booklet containing tables and figures on R&D statistics and other science and technology indicators has been published annually since 1997. The last five issues of the booklet are also available on http://www.nifu.no/foustat/startside_eng.html. A broader coverage of S&T input and output factors is contained in the publication *Report on Science and Technology Indicators for Norway 2003, NIFU, Oslo, May/June 2004*. Below, we describe the R&D statistics and their data sources more in detail. All expenditures are given in current prices, unless otherwise indicated. 1.00 PPP US$ = 9.11 NOK in 2003 (Main Science and Technology Indicators 2003-2, OECD).

**Who prepares the R&D statistics?**

R&D statistics in Norway are prepared every second year on commission from the Research Council of Norway. The Norwegian Institute for Studies in Research and Higher Education, NIFU, is responsible for the statistics on the Higher education sector and the Institute sector, while Statistics Norway does the statistics on the Industrial sector. NIFU is also responsible for aggregating total national R&D statistics. Further information may be obtained on the World Wide Web at NIFU's home page: http://www.nifu.no/foustat/, with links to the report mentioned above and the home pages of the Norwegian Research Council and Statistics Norway.

**How are R&D statistics compiled?**

Norwegian R&D statistics are compiled in accordance with the international guidelines issued by the OECD. These guidelines are contained in the "Frascati Manual" *(The Measurement of Scientific and Technological activities: Proposed Standard Practice for Surveys of Research and Development* "Frascati Manual 1993", OECD 1994, reprinted with revisions in 2002). The sections of this manual dealing with basic definitions and conventions have been issued in Norwegian by NIFU.

Norwegian R&D statistics are compiled every second year through administrative registers and questionnaires sent to the concerning units in the three performing sectors.

The survey of R&D activity in the **Industrial sector** contains all companies with 50 or more employees. In addition, the survey includes a number of selected companies with a minimum of 10 employees. Before 1995, the survey included only companies with 50 or more employees. The statistics on the Industrial sector from 1995 are therefore not comparable with those of the previous years.
The **Higher education sector** is thoroughly surveyed. Each individual department or corresponding equivalent unit is surveyed. University hospitals are also included in this sector. Supplementary sources of information include surveys on staff members' time usage, information on personnel and expenditure from the institutions' central administration, the Research Council of Norway, and medical foundations.
The **Institute sector** is also covered by complete surveys. Questionnaires are sent to research institutes and other institutions that are expected to perform R&D activities. In addition, this sector includes estimates of R&D resources at museums and non-university hospitals that are not included in the Higher education sector.

**Other data sources:**
The "Frascati Manual" also includes guidelines for **government budget appropriations or outlays for R&D (GBAORD)**. GBAORD are estimated annually by NIFU. Statistics on R&D personnel in the Higher education and Institute sectors are based on NIFU's register on research personnel, scientists, and engineers. The register is updated every second year. Data on **international R&D statistics** are extracted from the OECD's Main Science and Technology Indicators. Information on the Innovation survey comes from Statistics Norway. The **doctoral degree statistics** are based on NIFU's Norwegian doctoral degree register, which is updated biannually. Information on patent applications is collected by **STEP** from Norwegian Patent Office. **Bibliometric data** are extracted from the database National Citation Report for Norway prepared by the Institute for Scientific Information in the U.S. This database contains publication and citation statistics on articles from Norway.

## Highlights

- In 2001 the expenditure for R&D in Norway amounted to 24.5 billion NOK. As a share of the Gross Domestic Product (GDP) the R&D expenditure was 1.60% in 2001 compared to 1.65% in 1999.
- Norwegian R&D expenditure as a share of GDP and R&D expenditure per capita in 2001 were lower than in the other Nordic countries.
- In 2001, 51% of total R&D expenditure in Norway was funded by industry, 40% was funded by government, 2% by other national sources and 7% from abroad.
- Total R&D expenditure in fixed prices had an annual increase by more than 5% from 1999 to 2001. In the Industrial sector the growth rate was more than 10% per year, while R&D expenditure in the Higher education sector had no increase. The Institute sector had a real annual increase of 2% in the period.
- The R&D expenditure per capita was higher in Norway than in Denmark in 2001, but lower than in Sweden, Iceland and Finland.
- By county, Oslo and Sør-Trøndelag were the most R&D intensive areas in Norway in 2001, per capita.
- Basic research as a share of total R&D expenditure was 17% in 2001, the same as in 1999.
- Women as a share of total researchers in the Higher education sector was 36% in 2001, in the Institute sector 31% and Industrial sector 19%. The share of female researchers among full professors increased from 13% in 2001 to 16% in 2003.
- In the period 1999–2001, 40% of the firms in the Industrial sector collaborated with research institutes on innovation activities. Approximately the same share as those collaborating with universities and colleges.
- Government budget appropriations or outlays for R&D were estimated to 13.9 billion NOK in 2004.
- The number of awarded doctorates in Norway was lower in 2003 than in 2002, but higher than in 2001.
- In the period 1991–2002, the number of patent applications increased.
- The number of Norwegian co-authorships with other countries published in international scientific journals in 2002 is approximately the same as those without.

# Basic definitions of Research and Experimental Development (R&D)

**Research and experimental development** comprises work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

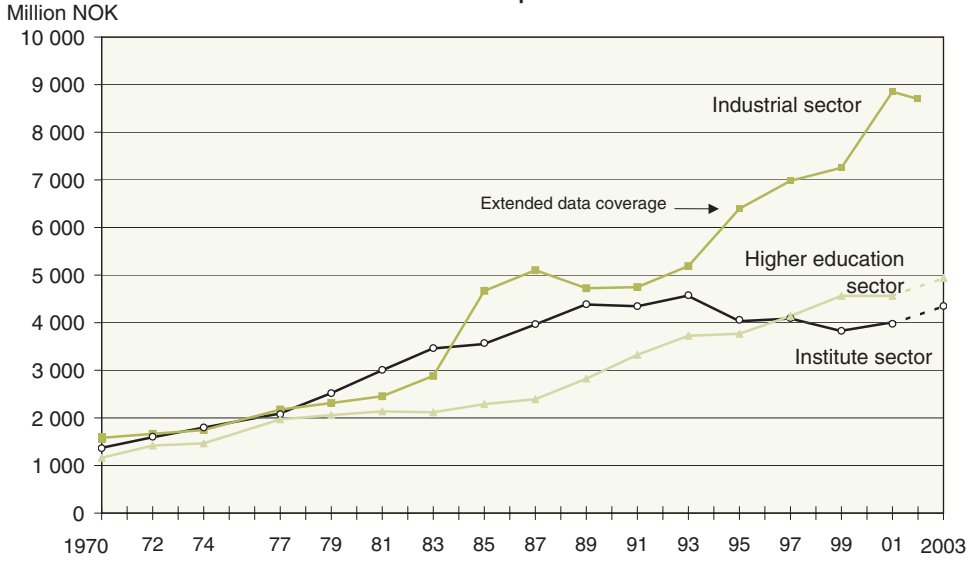
**Three types of R&D may be distinguished:**

- **Basic research** is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.
- **Applied research** is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.
- **Experimental development** is systematic work, drawing on existing knowledge gained from research and/or practical experience, that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

**Sector classification**

In Norwegian R&D statistics, resources are classified in three performing sectors: *The Industrial sector, the Higher education sector, and the Institute sector.* The Norwegian classification somewhat differs from the OECD's: OECD's Business enterprise sector includes both industry and private institutes that are business-oriented (however, these institutes are included in the Institute sector in Norway). OECD's *Higher education sector* corresponds to the Norwegian classification, while its *Government sector* and Private Non-Profit sector (PNP) together cover the rest of the Institute sector in Norway. The PNP sector is rather small in Norway, and it is therefore included in the Government sector of OECD's statistics.

**Figure 1 R&D expenditure in Norway by sector of performance: 1970–2003. Estimates for 2003. Fixed 1990-prices**



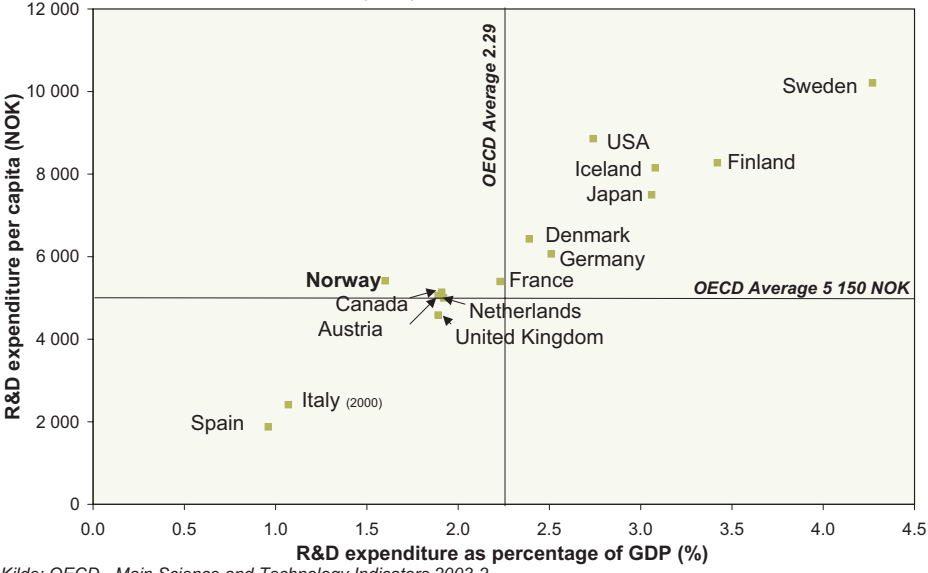

*Source: NIFU/Statistics Norway*

**Table 1 R&D expenditure in Norway by sector of performance and source of funds: 2001.**
**Million NOK**

| Sector of performance | Total | Source of funds | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Industry | | Government | | Other national sources | Abroad | |
| | | Total | Of which: Oil companies | Total | Of which: The Research Council of Norway | | Total | Of which: EU-comm. |
| Industrial sector | 12 613.7 | 10 800.4 | 808.1 | 839.4 | 235.5 | - | 973.9 | 101.7 |
| Institute sector | 5 581.5 | 1 348.9 | 226.9 | 3 402.9 | 1 282.6 | 215.3 | 614.4 | 159.6 |
| *Of which: Research institutes serving enterprises* | *1 985.8* | *968.3* | *171.9* | *661.9* | *399.8* | *111.1* | *244.5* | *77.5* |
| *Government sector* | *3 595.7* | *380.6* | *55.0* | *2 741.0* | *882.8* | *104.2* | *369.9* | *82.1* |
| Higher education sector | 6 274.2 | 365.2 | 74.6 | 5 415.3 | 997.0 | 324.0 | 169.7 | 105.0 |
| *Of which: Universities and Spec. University Inst.* | *5 596.6* | *342.4* | *70.7* | *4 784.0* | *960.4* | *306.7* | *163.5* | *100.3* |
| *State University Colleges* | *677.6* | *22.8* | *3.9* | *631.3* | *36.6* | *17.3* | *6.2* | *4.7* |
| Total | 24 469.4 | 12 514.5 | 1 109.6 | 9 657.6 | 2 515.1 | 539.3 | 1 758.0 | 366.3 |

*Source: NIFU/Statistics Norway*

**Figure 2 R&D expenditure per capita (NOK) and as a percentage of the Gross Domestic Product (GDP) in selected OECD countries: 2001**



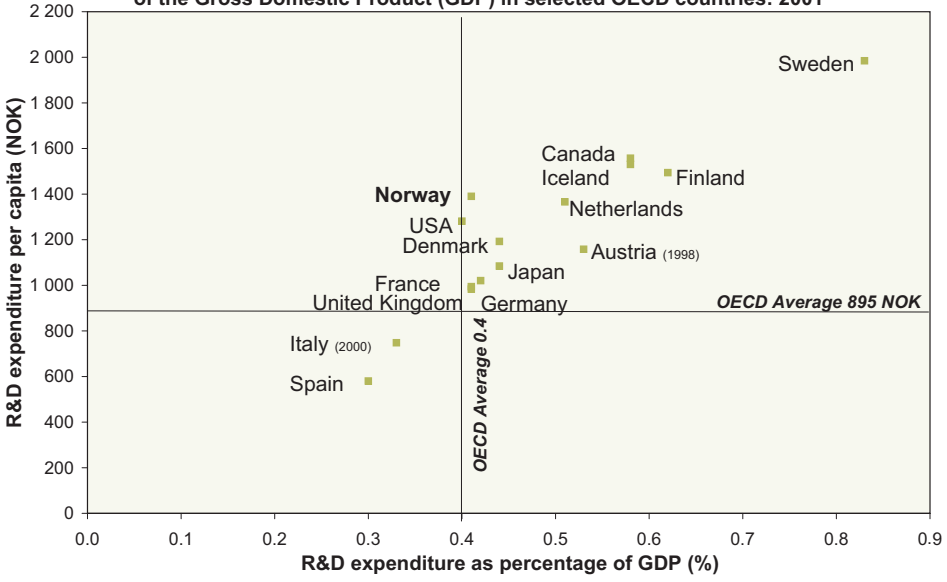

*Kilde: OECD - Main Science and Technology Indicators 2003-2*

**Table 2 R&D expenditure in selected OECD countries: 1999 and 2001**

| Country | Percentage of GDP | | Per capita NOK | | Share of public funding (%) | |
|---|---|---|---|---|---|---|
| | 1999 | 2001 | 1999 | 2001 | 1999 | 2001 |
| Austria | 1.86 | 1.92 | 4 437 | 4 999 | 40 | 41 |
| Canada | 1.81 | 1.91 | 4 445 | 5 139 | 32 | 31 |
| Denmark | 2.19 | 2.39 | 5 568 | 6 428 | 31 | 28 |
| Finland | 3.23 | 3.42 | 6 969 | 8 274 | 29 | 26 |
| France | 2.18 | 2.23 | 4 654 | 5 399 | 37 | 37 |
| Germany | 2.44 | 2.51 | 5 553 | 6 066 | 32 | 32 |
| Iceland | 2.39 | 3.08 | 5 964 | 8 151 | 41 | 34 |
| Italy | 1.04 | .. | 2 302 | .. | .. | .. |
| Japan | 2.95 | 3.06 | 6 771 | 7 497 | 20 | 19 |
| Netherlands | 2.02 | 1.89 | 4 957 | 5 060 | 36 | 36 |
| **Norway** | **1.65** | **1.60** | **4 554** | **5 416** | **43** | **40** |
| Spain | 0.88 | 0.96 | 1 556 | 1 876 | 41 | 40 |
| Sweden | 3.65 | 4.27 | 8 209 | 10 208 | 25 | 21 |
| United Kingdom | 1.88 | 1.89 | 4 111 | 4 585 | 29 | 30 |
| United States | 2.65 | 2.74 | 8 085 | 8 859 | 29 | 28 |
| Total OECD | 2.20 | 2.29 | 4 590 | 5 153 | 30 | 29 |
| European Union | 1.86 | 1.93 | 3 992 | 4 528 | 35 | 34 |

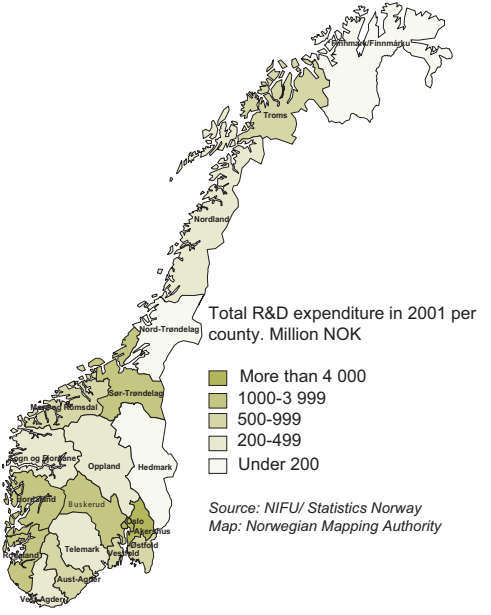
*Source: OECD - Main Science and Technology Indicators 2003-2*

**Figure 3 R&D expenditure in the Higher education sector per capita (NOK) and as a percentage of the Gross Domestic Product (GDP) in selected OECD countries: 2001**




*Kilde: OECD - Main Science and Technology Indicators 2003-2*

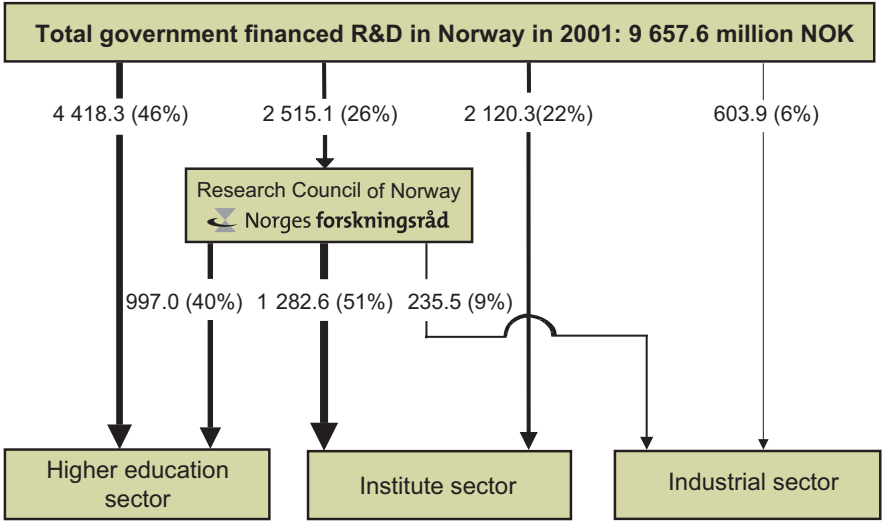
**Figure 4 Total R&D expenditure and R&D expenditure per capita in Norway by county: 2001**




| County | Million NOK | NOK per capita |
|---|---|---|
| Østfold | 651.2 | 2 594 |
| Akershus | 4 260.9 | 9 027 |
| Oslo | 6 741.3 | 13 251 |
| Hedmark | 134.6 | 716 |
| Oppland | 407.4 | 2 221 |
| Buskerud | 1 041.7 | 4 362 |
| Vestfold | 573.2 | 2 666 |
| Telemark | 399.6 | 2 413 |
| Aust-Agder | 605.7 | 5 897 |
| Vest-Agder | 230.7 | 1 471 |
| Rogaland | 1 157.9 | 3 086 |
| Hordaland | 2 711.2 | 6 186 |
| Sogn og Fjordane | 250.9 | 2 332 |
| Møre og Romsdal | 564.5 | 2 315 |
| Sør-Trøndelag | 3 211.2 | 12 124 |
| Nord-Trøndelag | 177.4 | 1 394 |
| Nordland | 296.4 | 1 244 |
| Troms | 973.3 | 6 413 |
| Finnmark | 61.5 | 830 |
| Total | 24 469.4[1] | 5 433 |

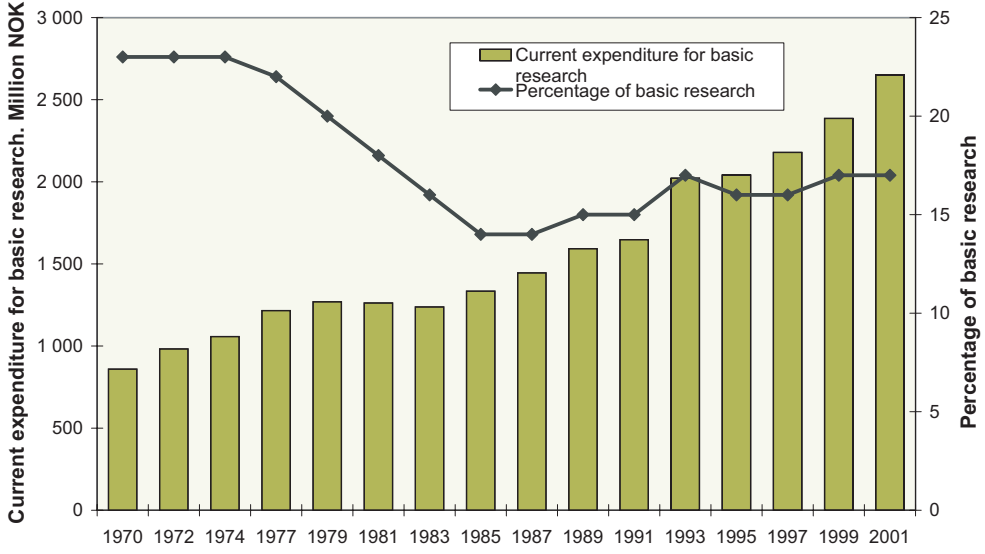
[1] UNIS included. The rest of Svalbard is included in Troms.
*Source: NIFU/Statistics Norway*

**Figure 5 Flow chart of government financed R&D to performing sectors in Norway: 2001**




*Source: NIFU/Statistics Norway*

**Figure 6 Current expenditure for basic research in fixed 1990 prices and as a percentage of total current R&D expenditure in Norway: 1970–2001. Million NOK and percentage**




*Source: NIFU/Statistics Norway*

**Table 3 R&D personnel (FTE) in Norway by sector of performance: 2001. Preliminary figures for 2003**

| Sector of performance | 2001 | | | 2003 |
|---|---|---|---|---|
| | University graduates | Other personnel | Total R&D personnel | University graduates |
| Industrial sector | 13 666 | 4 687 | 18 353 | .. |
| Institute sector | 6 077 | 3 208 | 9 285 | 6 350 |
| Higher education sector | 15 164 | 5 950 | 21 114 | 15 800 |
| *Of which: Universities* | *8 781* | *3 839* | *12 620* | *9 000* |
| *Specialised University Institutions* | *1 595* | *626* | *2 221* | *1 650* |
| *State University Colleges* | *4 788* | *1 485* | *6 273* | *5 150* |
| Total | 34 907 | 13 845 | 48 752 | .. |

*Source: NIFU/Statistics Norway*

**Table 4 Researchers/university graduates (head count) by sector of performance: 2001. Doctorates and share of women**

| Sector of performance | Total | | | Doctorates | | |
|---|---|---|---|---|---|---|
| | Total | Women | | Total | Women | |
| | | Number | % | | Number | % |
| Industrial sector | 13 666 | 2 574 | 19 | 1 069 | 180 | 17 |
| Institute sector | 6 077 | 1 912 | 31 | 1 816 | 454 | 25 |
| *Of which: Research institutes serving enterprises* | *1 957* | *477* | *24* | *616* | *114* | *19* |
| *Government sector* | *4 077* | *1 414* | *35* | *1 184* | *336* | *28* |
| Higher education sector | 15 164 | 5 418 | 36 | 4 979 | 1 205 | 24 |
| *Of which: Universities* | *8 781* | *2 878* | *33* | *3 798* | *941* | *25* |
| *Specialised University Institutions* | *1 595* | *527* | *33* | *581* | *135* | *23* |
| *State University Colleges* | *4 788* | *2 013* | *42* | *600* | *129* | *22* |
| Total | 34 907 | 9 904 | *28* | 7 864 | 1 839 | *23* |

*Source: NIFU/Statistics Norway*

**Table 5 Tenured academic/professional staff paid by general university funds in the Higher education sector, by position and type of institution: 2001 and 2003[1]**

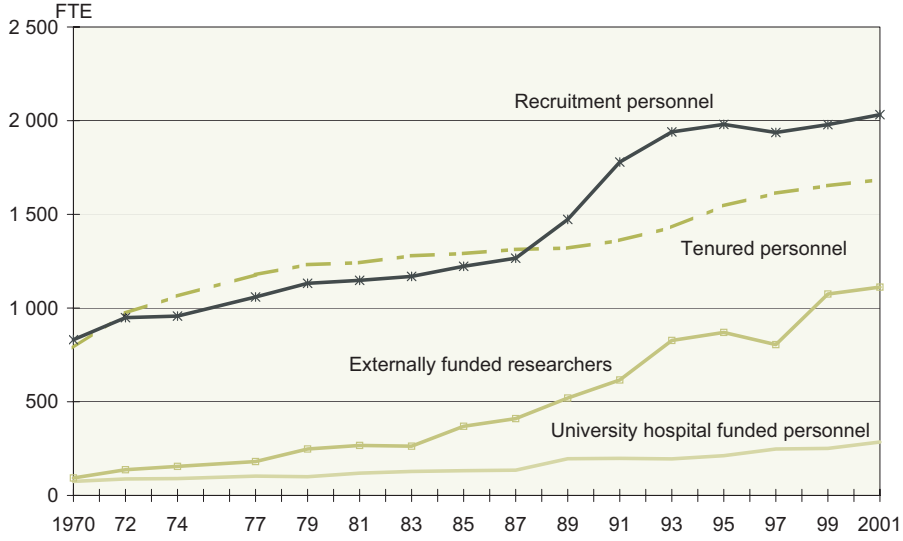
| Position | 2001 | | | | 2003[1] | | | |
|---|---|---|---|---|---|---|---|---|
| | Universities and Specialised University Institutions | | State University Colleges | | Universities and Specialised University Institutions | | State University Colleges | |
| | Total | % women | Total | % women | Total | % women | Total | % women |
| Professor | 2 116 | *14* | 174 | *10* | 2 335 | *16* | 210 | *16* |
| College reader | 10 | *30* | 44 | *14* | 0 | *0* | 40 | *10* |
| Associate professor | 1 742 | *31* | 940 | *23* | 1 675 | *31* | 985 | *27* |
| Senior lecturer | 49 | *47* | 348 | *28* | 70 | *36* | 420 | *30* |
| Assistant professor | 297 | *35* | 186 | *25* | 270 | *39* | 155 | *23* |
| University/ College lecturer[2] | 548 | *45* | 2 856 | *53* | 705 | *48* | 2 900 | *55* |
| Sum tenured position | 4 762 | *25* | 4 548 | *42* | 5 055 | *27* | 4 710 | *44* |

[1] Preliminary figures.

[2] Includes professional positions which require education at Master level.

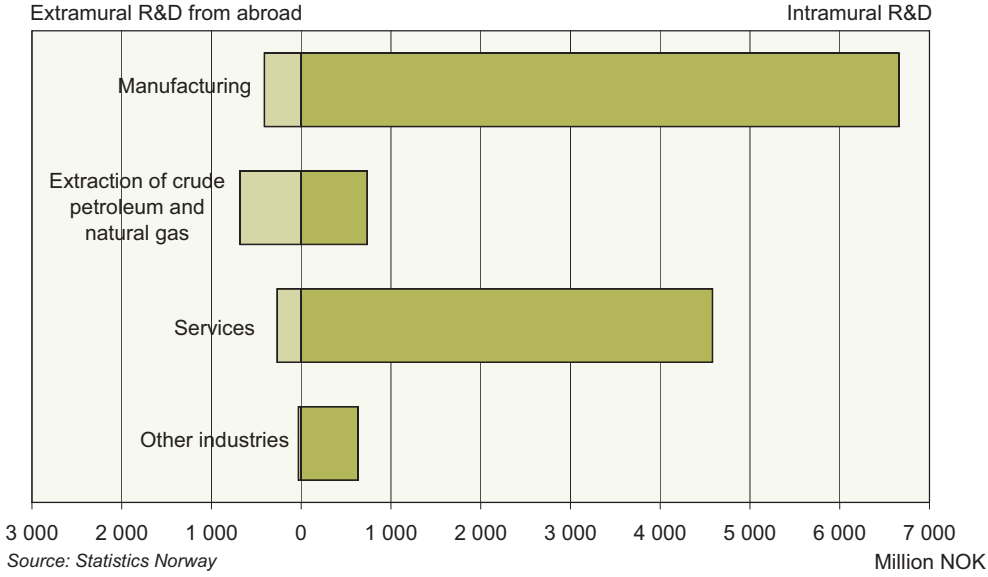
*Source: NIFU/Register of Research Personnel*

**Figure 7 Full time equivalent (FTE) R&D at Universities and Specialised University Institutions in Norway by category: 1970–2001**



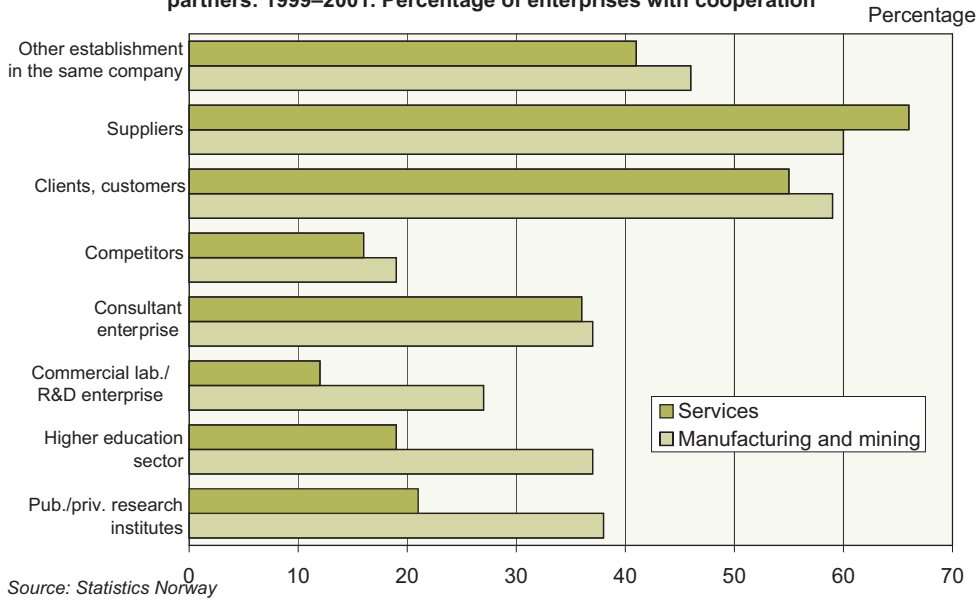

*Source: NIFU*

**Figure 8 The Industrial sector's intramural expenditure on R&D in Norway and R&D purchased from abroad by main industry: 2001. Million NOK**



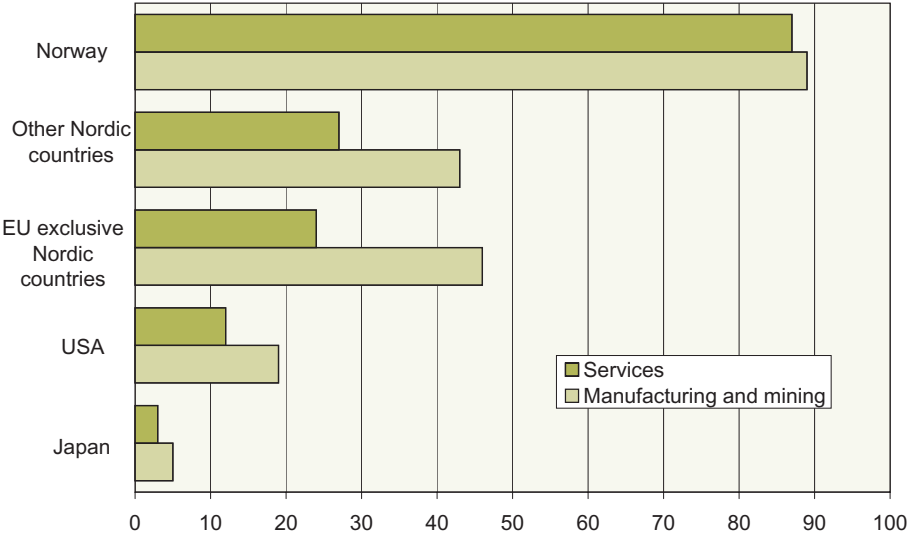

*Source: Statistics Norway*

**Figure 9 Cooperation partners for innovating enterprises in Norway by main industry and type of partners: 1999–2001. Percentage of enterprises with cooperation**




*Source: Statistics Norway*

**Figure 10 Cooperation partners for innovating enterprises by main industry and country: 1999–2001. Percentage of enterprises with cooperation**



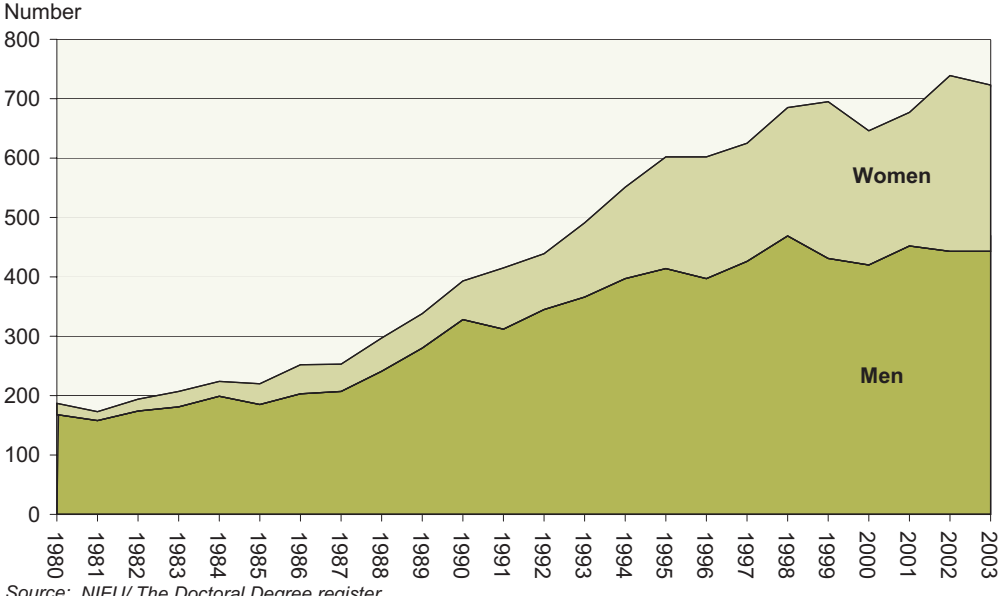

*Source: Statistics Norway*

**Table 6 Government budget appropriations or outlays for R&D (GBAORD) in Norway by Socio-economic objectives. Includes resources for R&D performed in Norway and abroad. Final budget: 2003 and 2004. Million NOK**

| Socio-economic objectives | 2003 | 2004 |
|---|---|---|
| Agriculture, forestry and fishery | 1 150 | 1 135 |
| *Of which: fishery* | *672* | *645* |
| Industrial development | 944 | 998 |
| Production and distribution of energy | 282 | 311 |
| Transport and telecommunications | 249 | 245 |
| Living conditions and physical planning | 18 | 18 |
| Environment | 300 | 286 |
| Health | 920 | 987 |
| Social conditions | 176 | 190 |
| Culture, mass media and leisure | 130 | 130 |
| Education | 81 | 85 |
| Working conditions | 82 | 78 |
| Economic planning and public administration | 361 | 375 |
| Exploration and exploitation of the earth and atmosphere | 243 | 270 |
| General advancement of knowledge | 6 398 | 7 048 |
| Space research | 240 | 259 |
| Defence | 850 | 865 |
| EU contingent | 310 | 570 |
| Total | 12 734 | 13 850 |

*Source: NIFU*

**Figure 11 Awarded doctoral degrees in Norway by gender: 1980 – 2003**



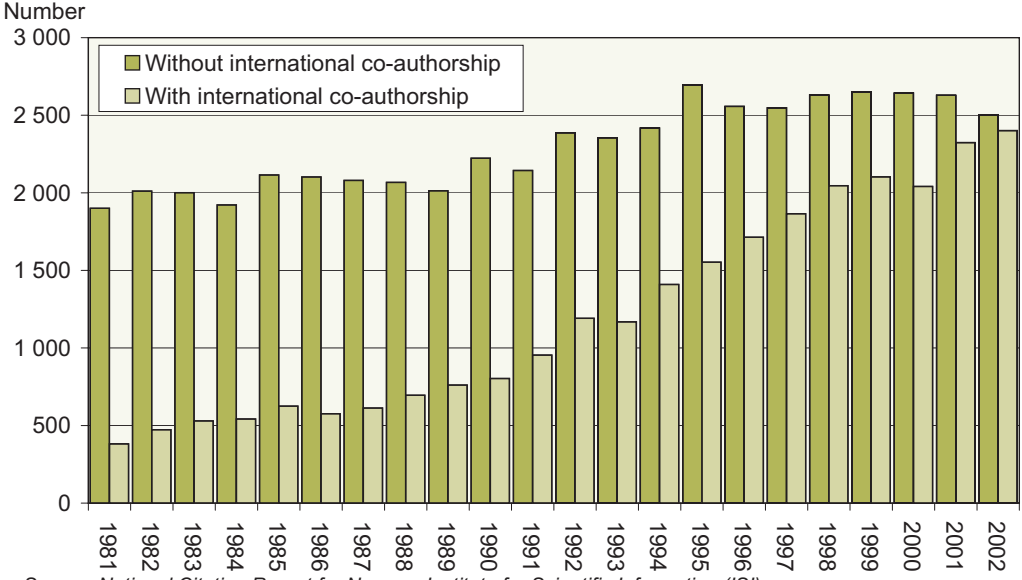

*Source: NIFU/ The Doctoral Degree register*

**Table 7 Patent applicants in Norway by the applicant's country: 1991–2002**

| Country | 1991–1993 | 1994–1996 | 1997–1999 | 2000–2002 |
|---|---|---|---|---|
| **Norway** | **2 873** | **3 540** | **3 895** | **3 948** |
| Denmark | 289 | 310 | 346 | 361 |
| Finland | 374 | 466 | 580 | 481 |
| Sweden | 819 | 1 009 | 1 243 | 1 105 |
| United Kingdom | 938 | 867 | 1 115 | 1 011 |
| Germany | 1 728 | 1 850 | 2 000 | 2 098 |
| France | 1 058 | 1 029 | 1 216 | 1 043 |
| Netherlands | 444 | 409 | 543 | 753 |
| Switzerland | 679 | 618 | 767 | 800 |
| The rest of Europe | 748 | 847 | 917 | 1 051 |
| USA | 4 247 | 4 147 | 5 018 | 5 171 |
| Canada | 135 | 201 | 249 | 235 |
| Japan | 527 | 556 | 711 | 865 |
| Other countries | 256 | 303 | 434 | 572 |
| Total applications | 15 115 | 16 152 | 19 034 | 19 494 |

*Source: Norwegian Patent Office and STEP*

**Figure 12 Norwegian articles with and without international co-authorship: 1981–2002**




*Source: National Citation Report for Norway, Institute for Scientific Information (ISI)*