Science and Technology Indicators

Norway
2003

NIFU Norwegian Institute for Studies in Research and Higher Education

Introduction

This booklet containing tables and figures on R&D statistics and other science and technology indicators have 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 2001, NIFU, Oslo, April 2002*. 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$ = 9,05 NOK in 2001 (Main Science and Technology Indicators 2002-2, 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 Industry 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/, 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 2002", OECD 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 **Industry 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 Industry 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,* and for national sources for the Nordic countries. The **doctoral degree statistics** are based on NIFU's Norwegian doctoral degree register, which is updated biannually. A new database, containing data on doctoral degrees in the Nordic and Baltic countries, **NORBAL**, has been established by NIFU: http://www.nifu.no/norbal/nb/eng/frontpage.html. **Bibliometric data** are extracted from the database *National Science Indicators* prepared by the *Institute for Scientific Information* in the U.S. This database contains worldwide publication and citation statistics.

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.

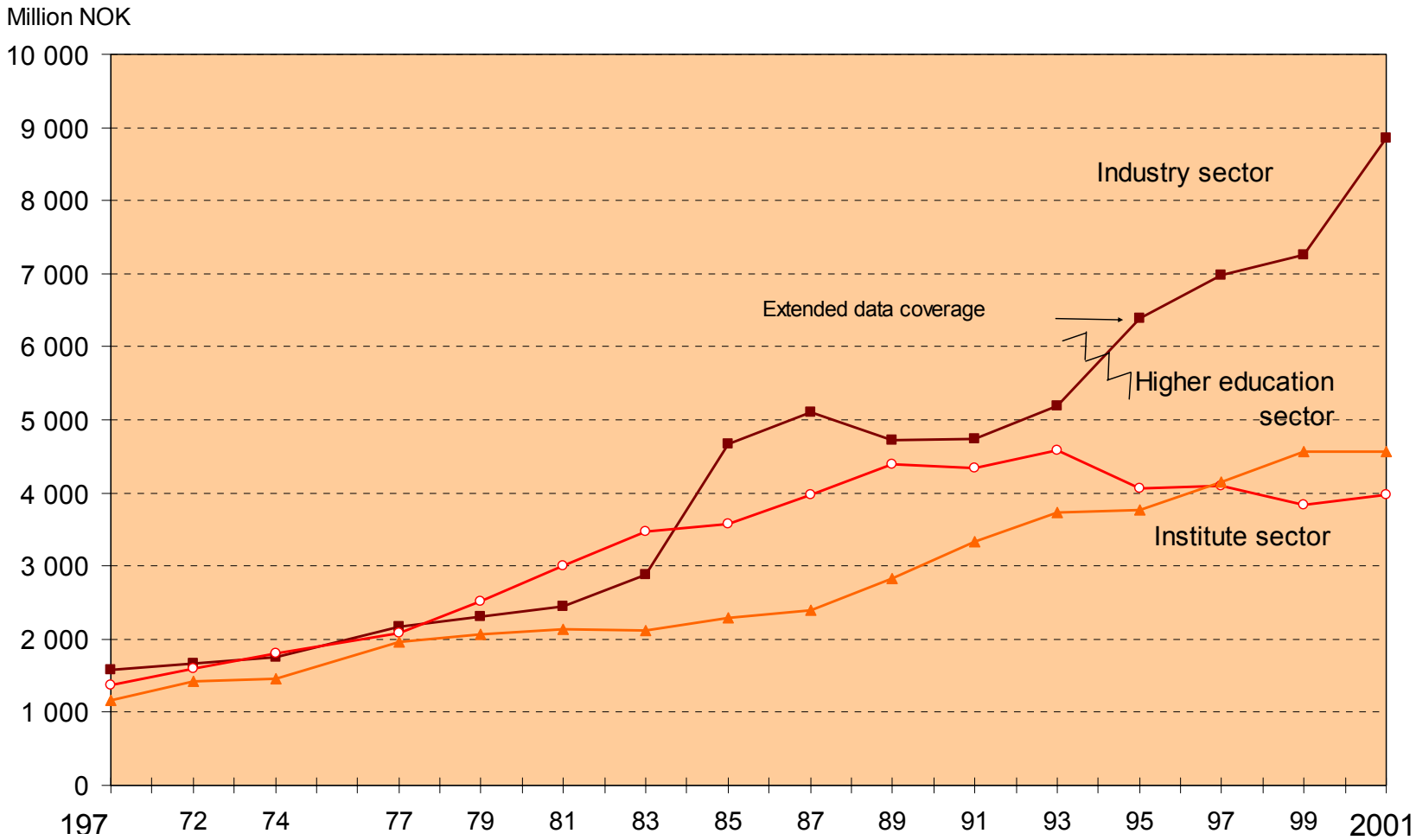
Sector classification

In Norwegian R&D statistics, resources are classified in three performing sectors: *The Industry 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.

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% came from abroad.
- As a performing sector, Industry spent 51% of total R&D expenditure in Norway in 2001. The Higher education sector spent 26% and the Institute sector 23%.
- Total R&D expenditure in fixed prices increased by 11% from 1999 to 2001. In the Industry sector the growth rate was 22%, while R&D expenditure in the Higher education sector experienced a stagnation due to low investments in capital R&D expenditure. In the Institute sector there was a real increase of approximately 4%.
- By region, the Oslo and Akershus area was the most R&D intensive in Norway in 2001. The R&D expenditure amounted to 11 200 NOK per inhabitant, followed by Trøndelag with 8 600 NOK per inhabitant.
- In 2001, 4.7 billion NOK was spent on R&D in Information and communication technology. In the period 1999 to 2001, Marine R&D experienced the highest increase, from 0.5 billion NOK to 1.4 billion NOK.
- Women as a share of total researchers in the Higher education sector increased from 34% in 1999 to 36% in 2001. The share of female researchers in the Institute sector increased from 29% to 32% during the period, while the share in the Industry sector was the same during the period, 19%.
- In 2001, the women`s share of total number of professors at the Norwegian universities was 14%, compared to 9% in 1991. The highest share of women among the professors was in the Humanities with 26%. In Engineering and technology only 2% of the professors were women.
- Government budget appropriations or outlays for R&D (GBAORD) are estimated to 12 billion NOK in 2003.
- The number of annually awarded doctorates in Norway is lower than for the rest of the Nordic countries, but higher than the total for the Baltic countries.
- Norwegian researchers published 5.4 articles in international journals per 1000 capita during 1998-2002

Figure 1 R&D expenditure in Norway by sector of performance: 1970–2001. Fixed 1990-prices



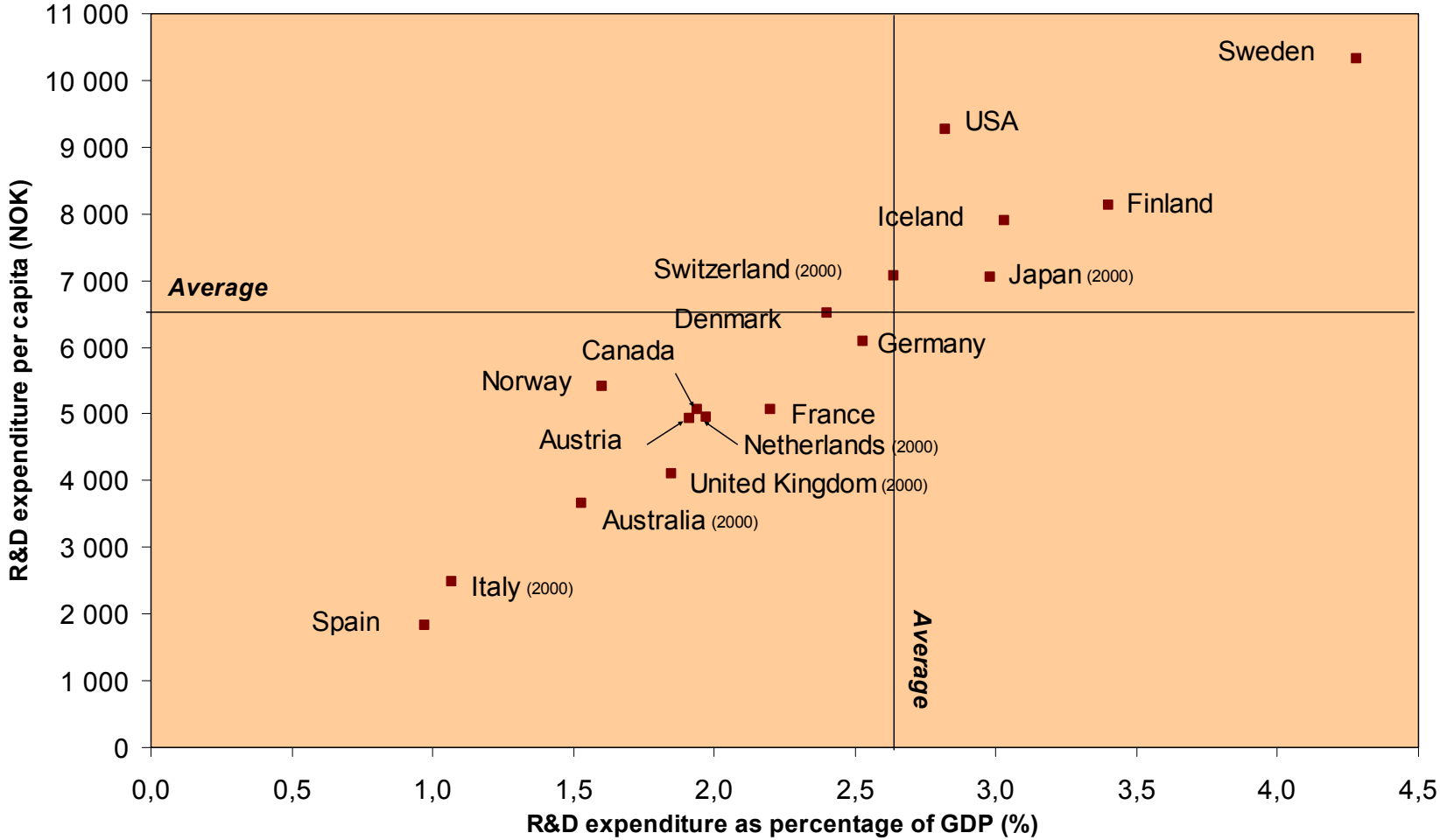
Source: NIFU/Statistics Norway

Table 1 Total 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 com-panies	Total	Of which: The Research Council of Norway		Total	Of which: EU-comm.
Industry 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	5 470.7	997.0	268.6	169.7	105.0
Of which: Universities and								
Spec. University Inst.	*5 596.6*	*342.4*	*70.7*	*4 839.4*	*960.4*	*251.3*	*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	9 713.0	2 515.1	483.9	1 758.0	366.3

Source: NIFU/Statistics Norway

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



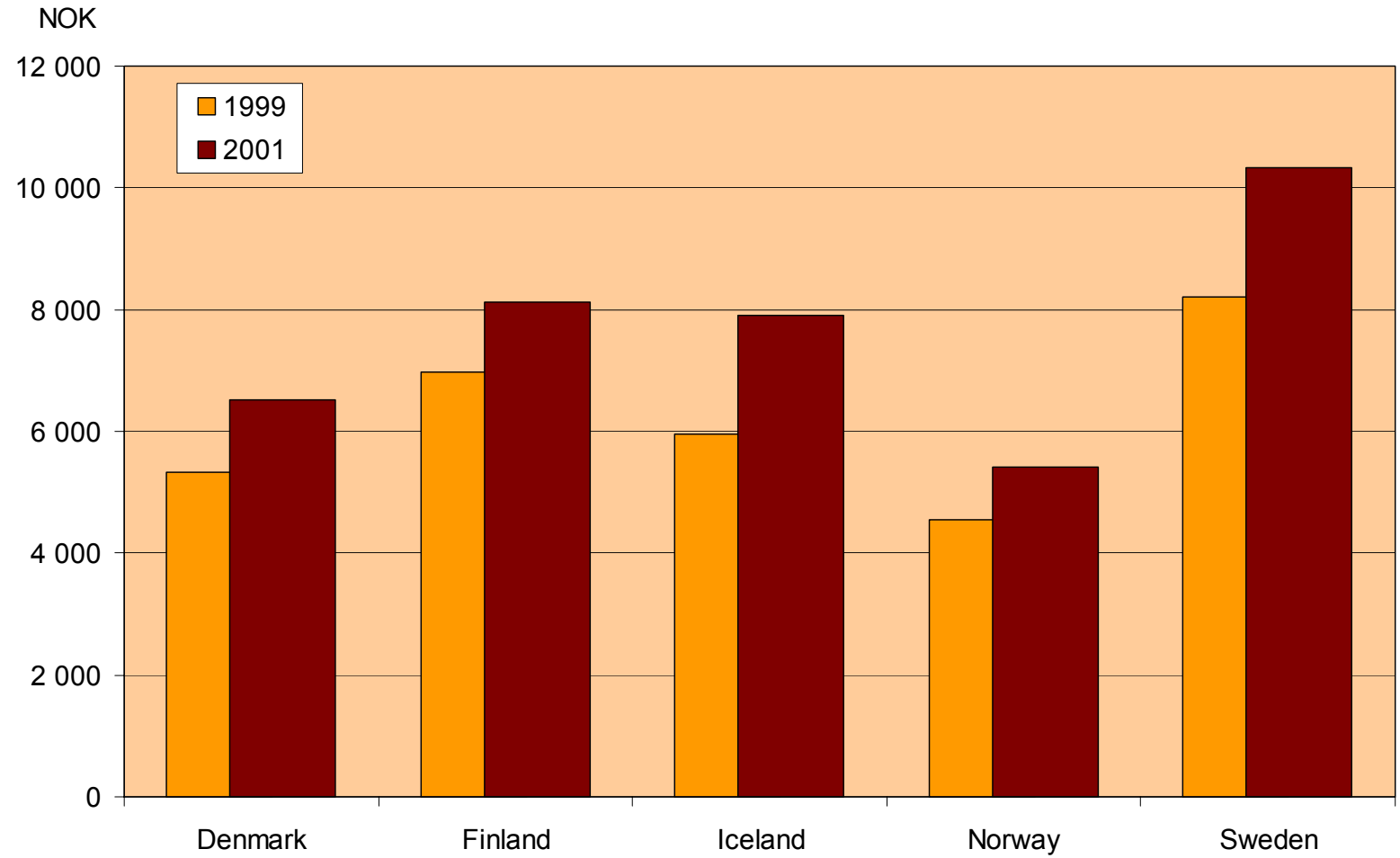
Source: OECD - Main Science and Technology Indicators 2002-2/Nordic R&D statistics

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	1.91	4 417	4 932	40	41
Canada	1.79	1.94	4 390	5 075	32	32
Denmark	2.09	2.43	5 336	6 518	33	..
Finland	3.22	3.40	6 969	8 123	29	28
France	2.18	2.20	4 654	5 087	37	..
Germany	2.44	2.53	5 552	6 085	33	31
Iceland	2.37	3.03	5 968	7 900	41	..
Japan	2.94	..	6 771	..	20	..
Netherlands	2.02	..	4 957	..	36	..
Norway	**1.65**	**1.60**	**4 554**	**5 422**	**43**	**40**
Spain	0.88	0.97	1 556	1 823	41	..
Sweden	3.78	4.28	8 209	10 322	25	26
United Kingdom	1.88	..	4 044	..	28	..
United States	2.65	2.82	8 266	8 932	29	27
Total OECD	2.20	..	4 632	..	30	..
European Union	1.86	..	3 978	..	35	..

Source: OECD - Main Science and Technology Indicators 2002-2/Nordic R&D statistics

Figure 3 R&D expenditure in the Nordic countries per capita: 1999 and 2001



Source: OECD - Main Science and Technology Indicators 2002-2/Nordic R&D statistics

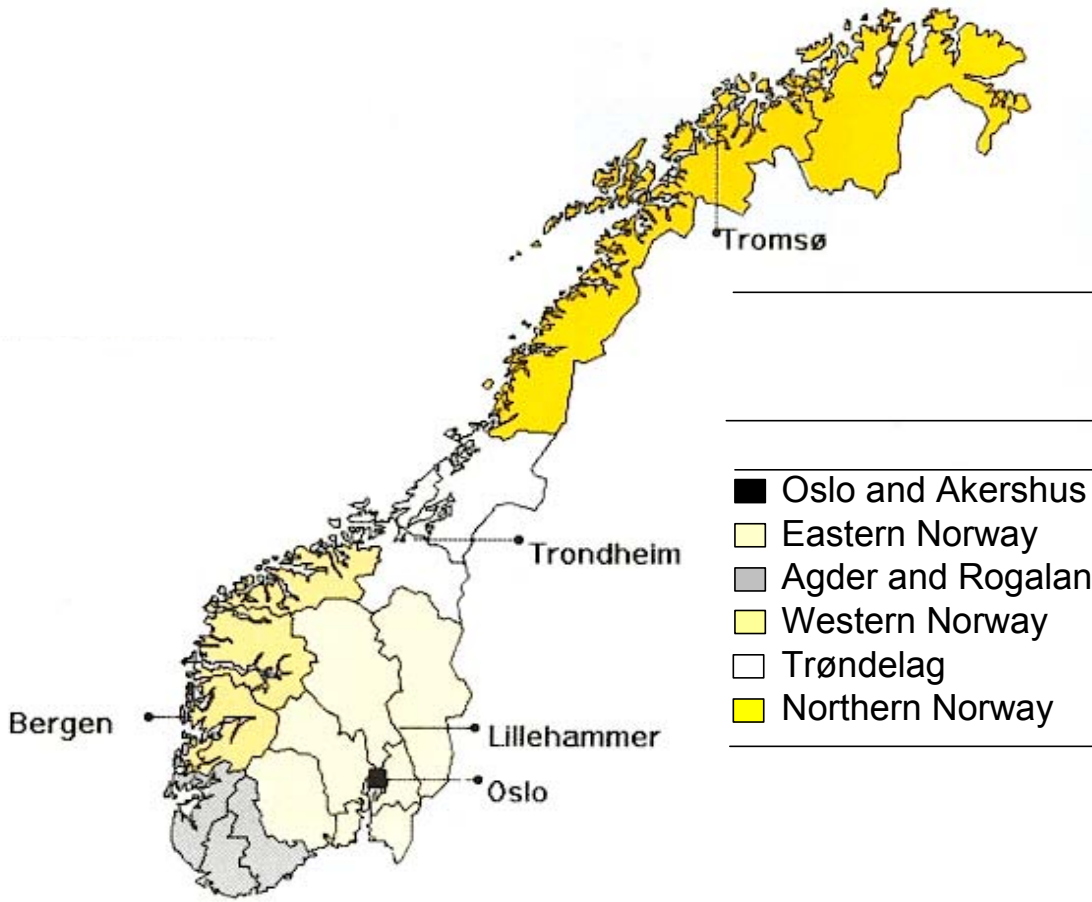
Table 3 R&D expenditure in the Nordic countries by sector of performance and as percentage of the Gross Domestic Product: 2001. Million national currency and per cent

	Denmark		Finland		Iceland		Norway		Sweden	
Sector of perfomance	DKK	(%)	EUR	(%)	ISK	(%)	NOK	(%)	SEK	(%)
Business enterprice sector	22 343.0	69	3 284.0	71	13 197.6	58	14 599.5	60	75 215.0	78
Of which: Industry sector	..		..		..		*12 613.7*		..	
Research institutes	..		..		..		*1 985.8*		..	
Government sector	2 950.0	9	500.9	11	5 090.0	23	3 595.7	15	2 750.8	3
Higher education sector	6 964.0	22	834.1	18	4 251.7	19	6 274.2	25	18 819.0	19
Total	32 257.0	100	4 619.0	100	22 539.3	100	24 469.4	100	96 784.8	100

Percentage of GDP	2.40	3.40	3.03	1.60	4.28

Source: Nordic R&D statistics

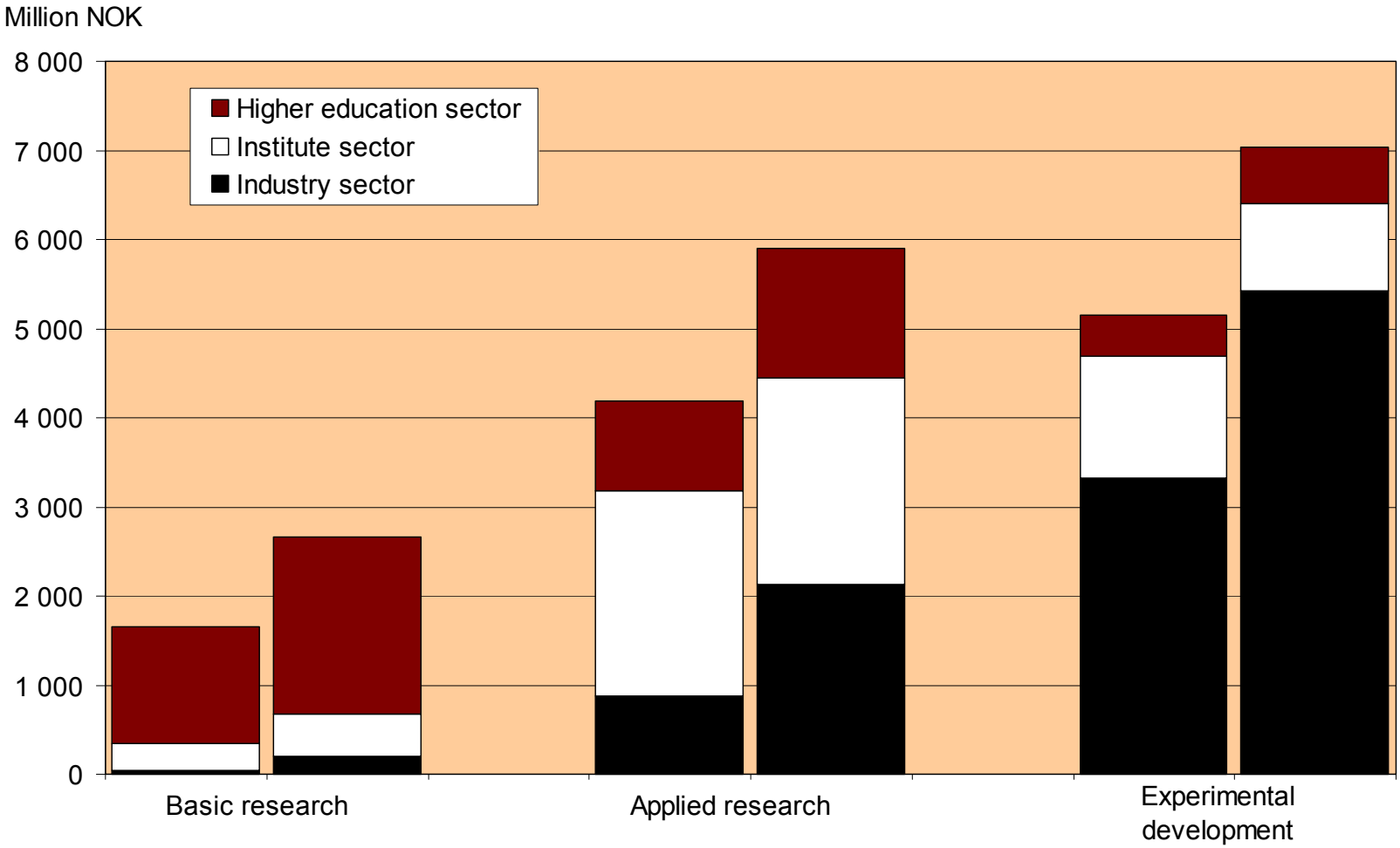
Figure 4 Total R&D expenditure and R&D expenditure per inhabitant in Norway by region: 2001



	Total R&D expenditure	R&D expenditure per inhabitant
	Billion NOK	NOK
Oslo and Akershus	11.0	11 200
Eastern Norway	3.2	2 600
Agder and Rogaland	2.0	3 100
Western Norway	3.5	4 500
Trøndelag	3.4	8 600
Northern Norway	1.4	2 900

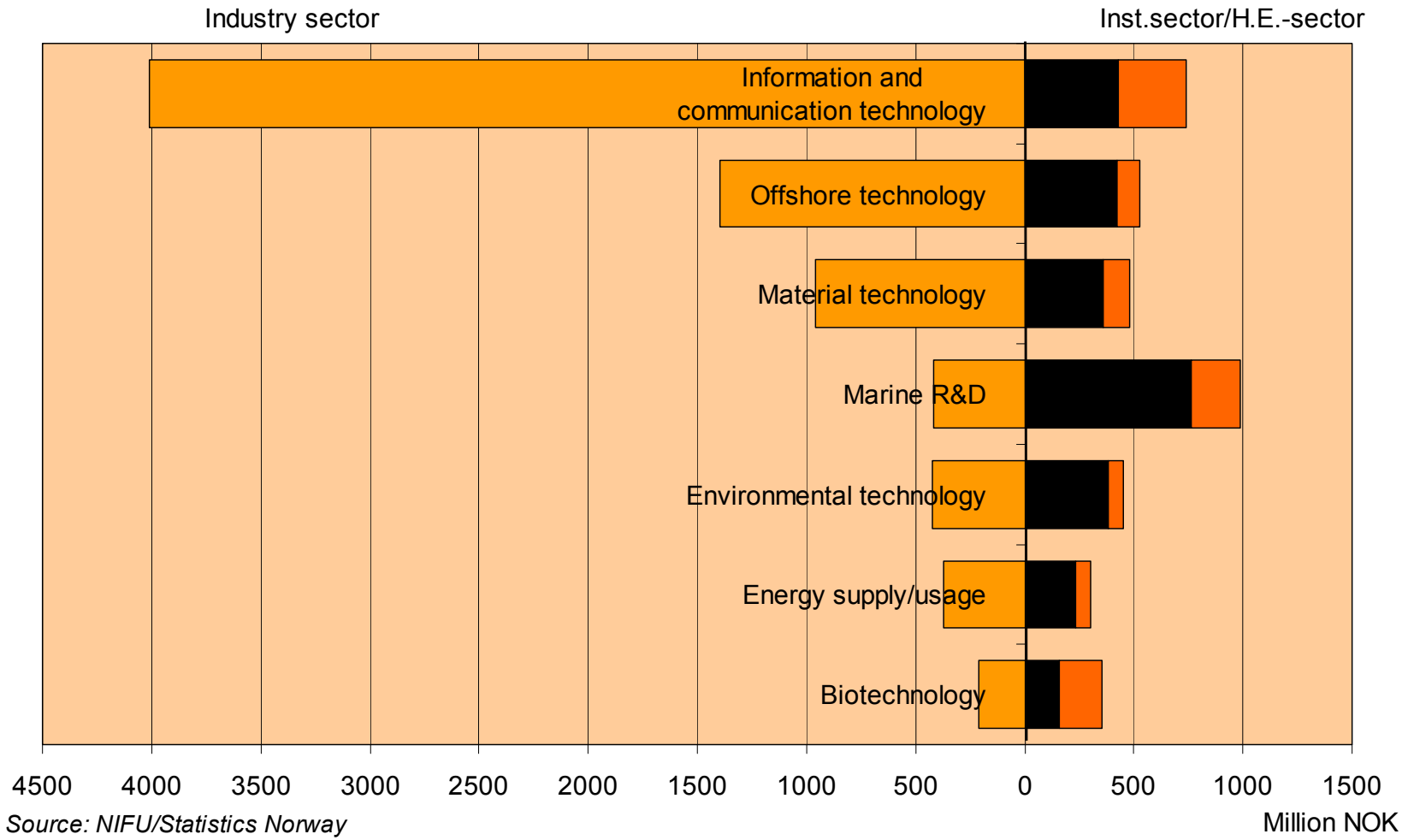
Source: NIFU/Statistics Norway

Figure 5 Current R&D expenditure in Norway by sector of performance and type of R&D: 1991 and 2001. Fixed 1990-prices



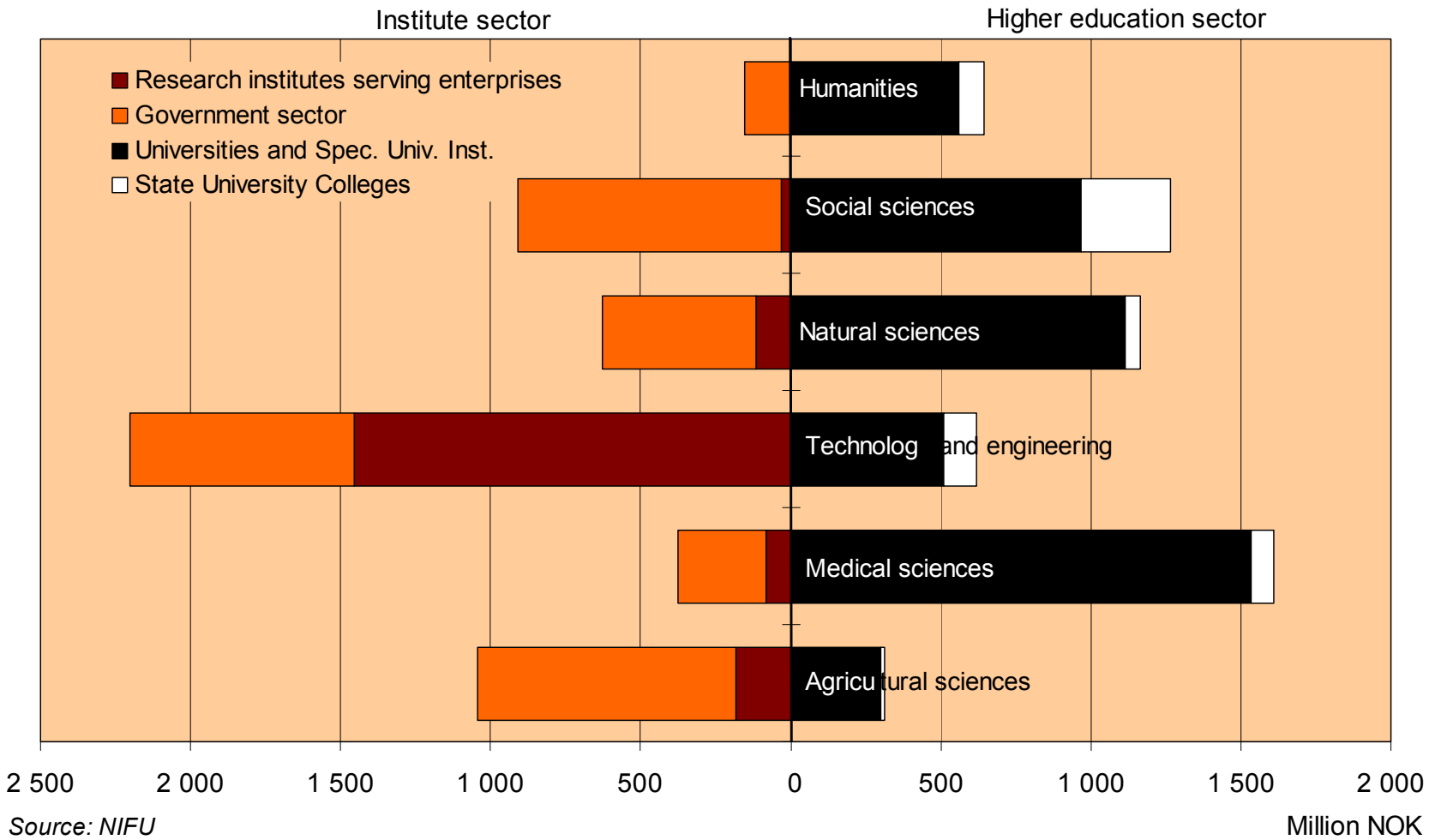
Source: NIFU/Statistics Norway

Figure 6 Current R&D expenditure in Norway by sector of performance and selected R&D fields: 2001. Million NOK



Source: NIFU/Statistics Norway

Figure 7 Current R&D expenditure in the Institute sector and the Higher education sector in Norway by field of science and technology: 2001. Million NOK



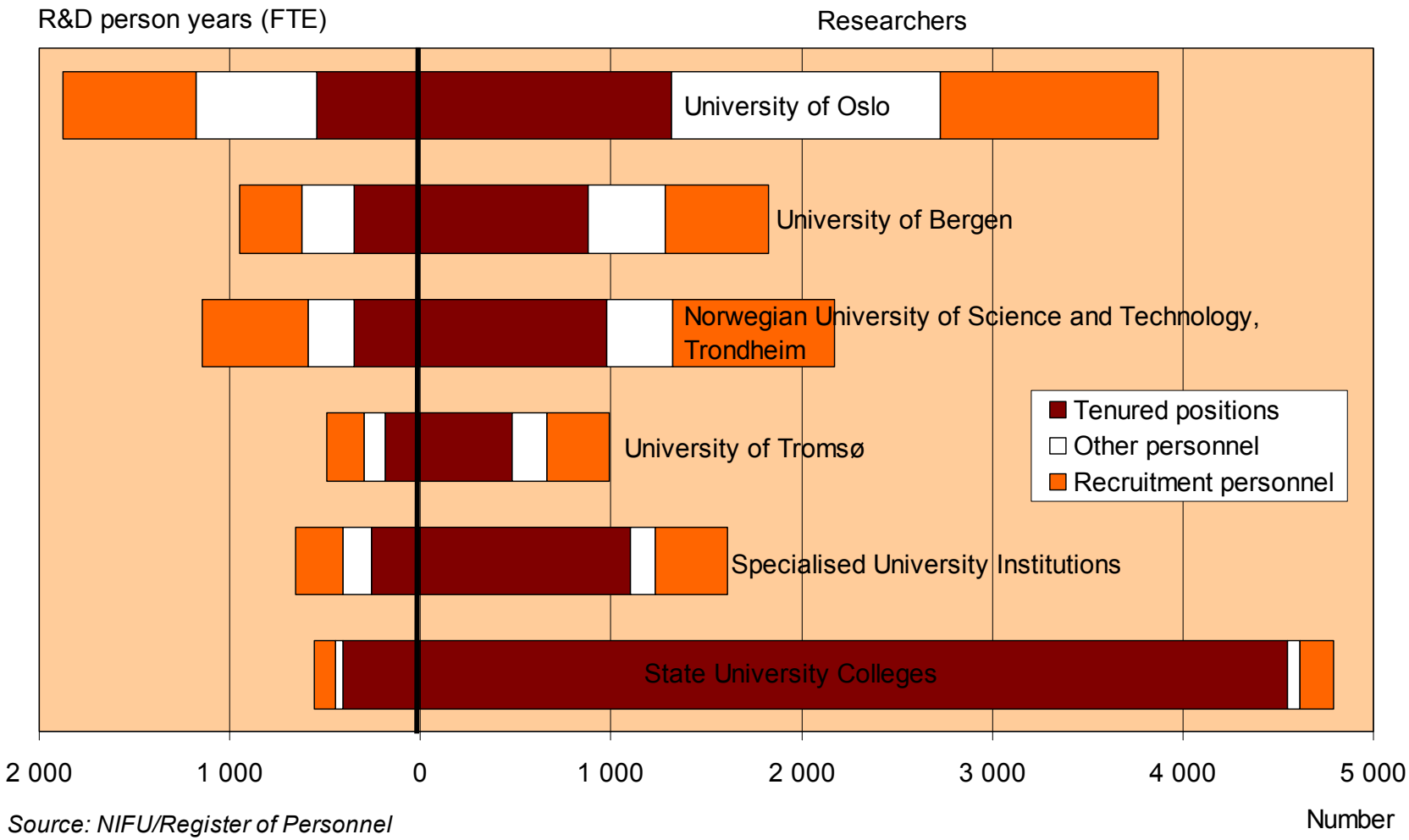
Source: NIFU

Table 4 R&D personnel (head count and FTE) in Norway by sector of performance: 2001

Sector of performance	R&D personnel as of 01.10.2001			R&D person years (FTE)	
	Total	Researchers/ university graduates	Technichians & supporting staff	Total	Of which: Researchers/ university graduates
Industry sector	17 843	13 355	4 488	12 166	9 358
Institute sector	9 285	6 077	3 208	6 988	4 723
Of which: Research institutes serving enterprises	*2 774*	*1 957*	*817*	*2 186*	*1 612*
Government sector	*6 511*	*4 120*	*2 391*	*4 802*	*3 111*
Higher education sector	21 114	15 164	5 950	7 484	5 670
Of which: Universities	*12 620*	*8 781*	*3 839*	*5 884*	*4 461*
Specialised University Inst.	*2 221*	*1 595*	*626*	*741*	*558*
State University Colleges	*6 273*	*4 788*	*1 485*	*859*	*651*
Total	48 242	34 596	13 646	26 638	19 751

Source: NIFU/Statistics Norway

Figure 8 R&D person years (FTE) and researchers (head count) in the Higher education sector in Norway by institution: 2001



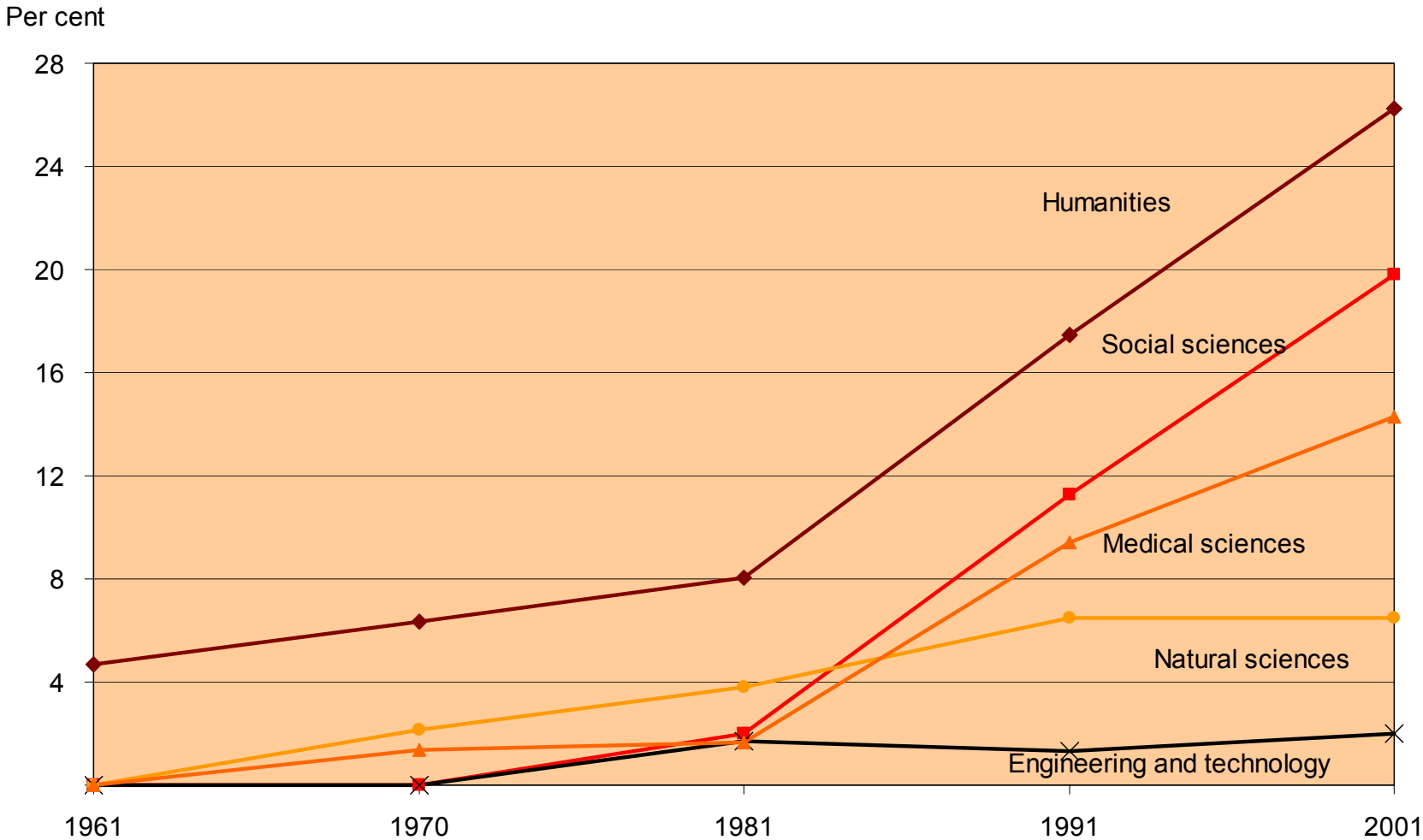
Source: NIFU/Register of Personnel

Table 5 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	%
Industry sector	13 355	2 465	*18.5*	998	162	*16.2*
Institute sector	6 077	1 912	*31.5*	1 816	454	*25.0*
Of which: Research institutes serving enterprises	*1 957*	*477*	*24.4*	*616*	*114*	*18.5*
Government sector	*4 077*	*1 414*	*34.7*	*1 184*	*336*	*28.4*
Higher education sector	15 164	5 418	*35.7*	4 979	1 205	*24.2*
Of which: Universities	*8 781*	*2 878*	*32.8*	*3 798*	*941*	*24.8*
Specialised University Inst.	*1 595*	*527*	*33.0*	*581*	*135*	*23.2*
State University Colleges	*4 788*	*2 013*	*42.0*	*600*	*129*	*21.5*
Total	34 596	9 795	*28.3*	7 793	1 821	*23.4*

Source: NIFU/Statistics Norway

Figure 9 Female professors as share of total professors at Norwegian universities by field of science and technology: 1961 - 2001



Source: NIFU/Register of Research Personnel

Table 6 R&D expenditure and R&D personnel (FTE) performed in the Industry sector in Norway by industry: 2001

Industry (SN 94)	R&D expenditure		R&D person years (FTE)	
	1999 Mil. NOK	2001 Mil. NOK	1999 Number	2001 Number
Fishing, operations of fish hatcheries and fish farms (5)	169.4	288.9	164	210
Extraction of crude petroleum and natural gas (11)	782.4	736.3	588	375
Total industry and mining (13-37)	4 740.8	6 660.1	5 827	6 415
Of which: Chemicals and chemical products (23-24)	*942.7*	*1 039.0*	*1 151*	*1 104*
Machinery and equipment (29)	*569.2*	*870.6*	*790*	*1 177*
Electrical and optical equipment (30-33)	*1 853.0*	*2 691.3*	*2 048*	*2 310*
Transport equipment, furniture and other (34-37)	*370.2*	*796.6*	*454*	*592*
Other industry and mining	*1 005.7*	*1 262.6*	*1 384*	*1 232*
Electricity, gas and water supply (40-41)	80.3	84.4	55	76
Construction (45)	51.8	260.8	52	236
Total services (50-99)	3 715.3	4 583.2	4 309	4 855
Of which: Transport and telecommunication (60-64.2)	*747.9*	*795.7*	*744*	*856*
Financial intermediation (65-67)	*196.0*	*449.8*	*176*	*172*
Computer and related activities (72)	*1 560.1*	*1 941.6*	*1 960*	*2 193*
Other business activities and consultant services (74)	*874.9*	*768.5*	*988*	*924*
Other services	*336.4*	*627.6*	441	*710*
Total	9 540.0	12 613.7	10 995	12 166

Source: Statistics Norway

Table 7 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: 2002 and 2003. Million NOK

Socio-economic objectives	2002	2003
Agriculture, forestry and fishery	1 253	1 093
Of which: fishery	*837*	*653*
Industrial development	992	1 041
Production and distribution of energy	244	223
Transport and telecommunications	224	249
Living conditions and physical planning	19	18
Environment	301	299
Health	839	920
Social conditions	140	168
Culture, mass media and leisure	127	138
Education	82	81
Working conditions	99	82
Economic planning and public administration	353	397
Exploration and exploitation of the earth and atmosphere	223	243
General advancement of knowledge	5 628	6 349
Space research	247	240
Defence	495	501
EU contingent	558	310
Total	11 824	12 352

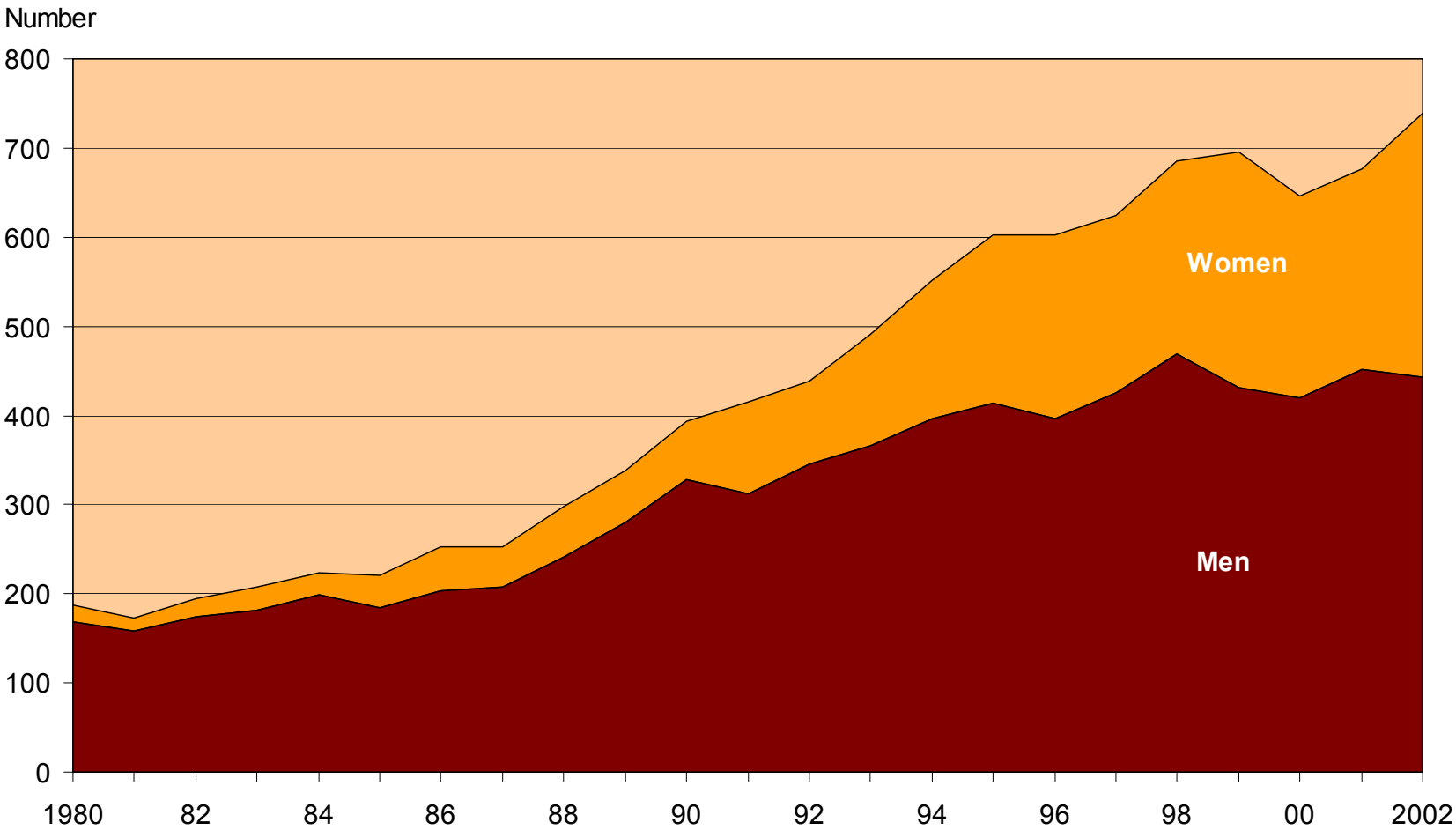
Source: NIFU

Table 8 Doctorates in the Nordic and Baltic countries in 1990 and 1995–2000

Country	1990	1995	1996	1997	1998	1999	2000
Denmark	410	796	824	956	934	977	1 000
Finland	490	758	851	934	988	1 164	1 156
Iceland	1	3	1	4	3	3	5
Norway	**393**	**602**	**602**	**625**	**685**	**695**	**646**
Sweden	1 095	1 520	1 682	1 799	1 928	2 147	2 175
Total Nordic countries	2 389	3 679	3 960	4 318	4 538	4 986	4 982
Estonia	..	29	38	48	106	135	117
Latvia	164	67	93	118	174	122	43
Lithuania	313	96	116	143	196	217	472
Total Baltic countries	477	192	247	309	476	474	632
Total	2 866	3 871	4 207	4 627	5 014	5 460	5 614

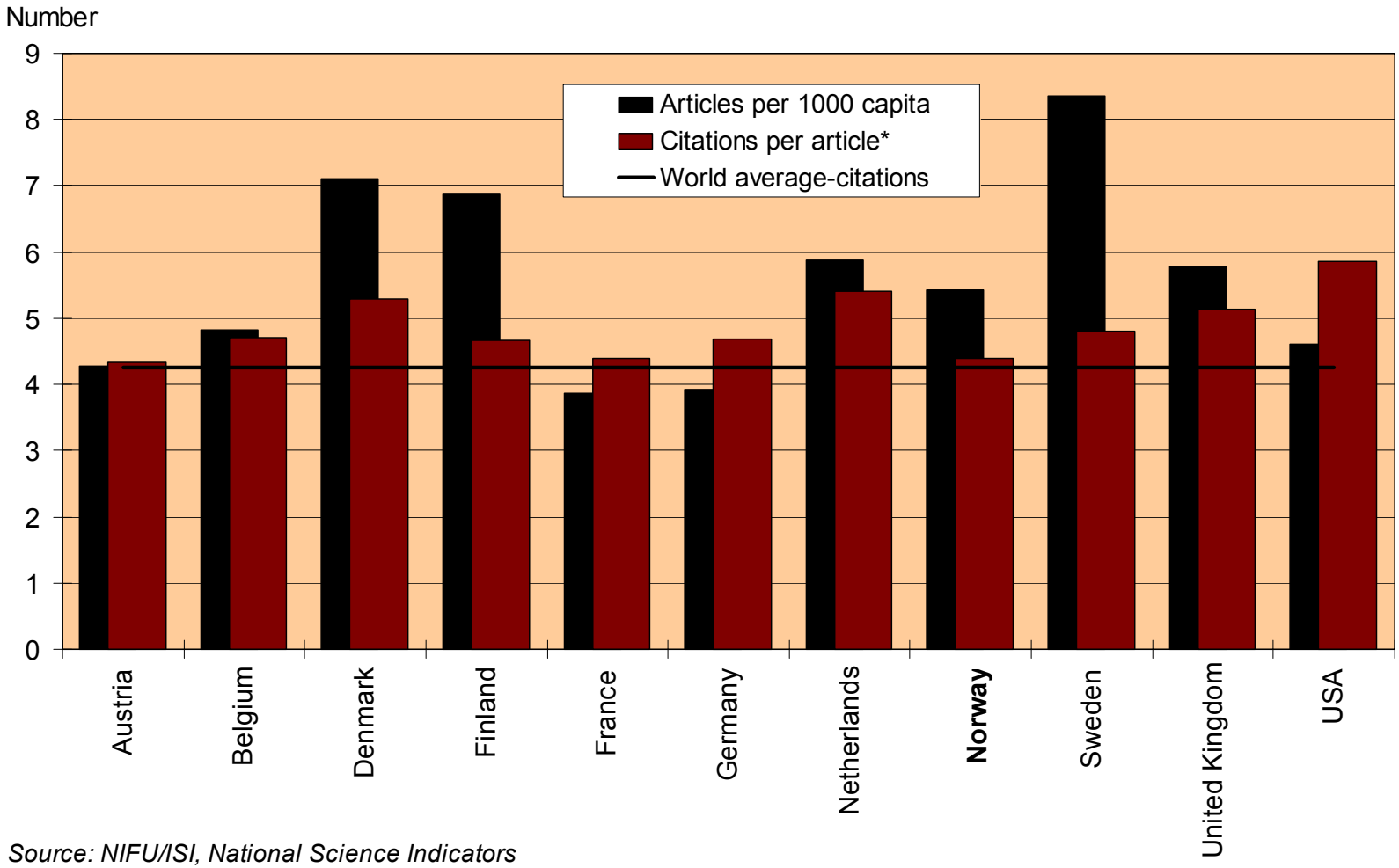
Source: NORBAL

Figure 10 Earned doctoral degrees in Norway by gender: 1980-2002



Source: The Doctoral Degree register, NIFU

Figure 11 Articles per 1000 capita and citations per article for selected countries: 1998-2002



Source: NIFU/ISI, National Science Indicators

**) The indicators have been weighted according to a world average field distribution of articles*