Earth Sciences Research at Norwegian Universities and Colleges

A review

Volume II: Data from Norwegian R&D Statistics 1995

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Introduction

The following presents tables on R&D expenditures and scientific personnel mainly at units dealing with earth sciences at the four universities of Norway and the Agricultural University of Norway. The units may be called university departments of earth sciences in the sense that most of their R&D activities are related to these sciences. The included units are[1]:

University of Oslo:
Department of Geology
Mineralogical Geological Museum
Paleontological Museum
Department of Geography
Department of Geophysics

University of Bergen:
Geophysical Institute
Department of Geology
Institute of Solid Earth Physics

University of Trondheim (NTNU from 1.1.96)[2]:
Department of Geology and Mineral Resources Engineering, NTH
Department of Petroleum Engineering, NTH

University of Tromsø:
Department of Geology

Agricultural University of Norway:
Department of Soil and Water Sciences

From 1995 the classification by subject fields was changed. For this reason the 1993 figures in this paper are corrected to be comparable with 1995 figures.

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[1] The selection of the units was undertaken in collaboration with the Science and Technology Division at the Research Council of Norway. For two of the departments (Department of Petroleum Engineering at the University of Trondheim (NTNU) and Department of Soil and Water Sciences at the Agricultural university of Norway (NLH)) only part of the activities is directed towards earth and related environmental sciences. In these two cases the R&D expenditures are estimated as part of the total expenditures in the department, based on the number of scientific personnel involved in geology. It should be mentioned that two of the departments are not classified as departments of earth sciences in the Norwegian R&D statistics, and that the total figures for earth sciences in this paper are not comparable with the official figures.

[2] Abbreviations.
NTNU: Norwegian University of Science and Technology (from 1.1.1996)
NTH: Norwegian Institute of Technology at the University of Trondheim (before 1.1.1996)

R&D expenditures

Norwegian R&D statistics for 1995 were completed in April 1997. The figures in this presentation are based on the R&D statistics in the higher education sector (HES). In the following tables we present data on R&D expenditures within the earth sciences as part of the HES, and data on R&D expenditures within the twelve units dealing with earth sciences.

Table 1
R&D expenditures in earth sciences in relation to total R&D expenditures in 1993 and 1995. (NOK million).

Category	1993	1995	Change in per cent
Total R&D expenditures in Norway[1]	14,335.6	15,970.4	
Of which Higher Education Sector	3,893.7	4,139.1	6,3
Of which natural sciences[2]	1,079.7	1,069.9	-0,9
Of which earth sciences	130.2	126.1	-3,1

Source: NIFU

[1] In 1995 the survey in the industry sector was expanded. The total figures are not comparable with those of previous years.
[2] The figures on subject field for 1993 are corrected to 1995 standards.

Table 1 shows that there has been an increase in total R&D expenditures in Norway from 1993 to 1995. However, this increase is not real. There is a break in the series due to a large extension in the Business Enterprise sector, and the 1995-figures are not comparable with those of 1993. Corrected for this extension the total R&D expenditures in Norway in 1995 is 15 bil. NOK. This represent a 4,9 per cent increase in current prices from 1993 to 1995, in fixed prices this represent a small decrease.

Most of the research activity in the HES is financed from the general grant from the Ministry of Education, Research and Church Affairs; the public general university funds (GUF). The rest of the activity is financed from direct funding, i.e. business and industry, direct government funding or other sources of funds.

Table 2
R&D expenditures on current costs and scientific equipment by main source of funding in the HES in 1995. (NOK million).

Main source of funding	Current costs	Scientific equipment	Total
GUF	2,505.1	115.3	2,620.4
Direct funding	1,175.0	46.1	1,221.1
Total	3,680.1	161.4	3,841.5

Source: NIFU

Current costs include labour costs (salaries etc.) and other current expenditures such as non-capital purchases of materials, supplies and equipment to support R&D.

Of the R&D expenditures on current costs and scientific equipment 68 per cent were funded from general university funds (GUF). Current costs' share of total expenses was close to 70 per cent. It is noticeable that only 30 per cent of scientific equipment was funded by external funds.

The next four tables are concentrated on the twelve units of earth sciences. The tables present data on R&D expenditures in these units.

Table 3
R&D expenditures on current costs and scientific equipment at university departments of earth sciences by main source of funding in 1995. (NOK million).

Institution	GUF	Direct funding	Total	Direct funding, percentage of total expenditures
Univ. of Oslo	***28.9***	***18.2***	***47.1***	***39***
Department of Geology	11.4	10.4	21.8	48
Mineralogical Geological Museum	5.0	0.8	5.8	14
Paleontological Museum	2.1	0.3	2.4	13
Department of Geography	4.1	1.3	5.4	25
Department of Geophysics	6.3	5.4	11.7	46
Univ. of Bergen	***27.6***	***28.9***	***56.5***	***51***
Geophysical Institute	9.1	6.9	16.0	43
Department of Geology	10.3	9.2	19.5	47
Institute of Solid Earth Physics	8.2	12.8	21.0	61
Univ. of Trondheim (NTNU from 1.1.1996)	***11.8***	***8.0***	***19.8***	***40***
Engineering	8.5	4.5	13.0	35
The whole department of Petroleum Engineering	*11.0*	*14.0*	*25.0*	*56*
Geophysical part of this department	3.3	3.5	*6.8*	51
Univ. of Tromsø	***12.6***	***4.9***	***17.5***	***28***
Department of Geology	12.6	4.9	17.5	28
Agricultural University of Norway	***2.1***	***1.3***	***3.4***	***38***
The whole department of Soil and Water Sciences	*9.2*	*6.4*	*15.6*	*41*
Geological part of this department	2.1	1.3	3.4	38
Total	83.0	61.3	144.4	42

Source: NIFU

As mentioned, only a share of the R&D activities at the Department of Petroleum Engineering at NTNU and the Department of Soil and Water Sciences at NLH is related to earth sciences. In Table 3 above the figures for the geological share of the activities at the departments are *estimated*. The estimated figures are presented beneath the figures covering the expenditures for the departments as a whole. Only the geological parts of the two departments are included in total R&D expenditures at the bottom of the table.

Table 2 shows that direct funding of total R&D expenditures on current costs and scientific equipment in the HES was 1,2 bil NOK, close to 32 per cent. Table 3 shows that the same percentage for the selected units in earth sciences in 1995 was 42 per cent.

The next table shows how the GUF is divided between current costs and scientific equipment.

Table 4
R&D financed by GUF for current costs and scientific equipment at university departments of earth sciences in 1995. (NOK million).

Institution	Current costs	Scientific equipment
Univ. of Oslo	***27,8***	***1,2***
Department of Geology	11,0	0,3
Mineralogical Geological Museum	4,5	0,5
Paleontological Museum	2,1	0,0
Department of Geography	4,0	0,2
Department of Geophysics	6,2	0,2
Univ. of Bergen	***26,3***	***1,2***
Geophysical Institute	8,7	0,4
Department of Geology	9,8	0,5
Institute of Solid Earth Physics	7,8	0,3
Univ. of Trondheim (NTNU from 1.1.1996)	***12,0***	***0,1***
Department of Geology and Mineral Resources Engineering	8,5	-
The whole department of Petroleum Engineering	*10,9*	*0,1*
Geophysical part of this department	3,5	..
Univ. of Tromsø	***8,5***	***4,1***
Department of Geology	8,5	4,1
Agricultural University of Norway	***1,5***	***..***
The whole department of Soil and Water Sciences	*9,0*	*0,2*
Geological part of this department	1,5	..
Total	76,1	..

Source: NIFU

Table 4 shows that current costs represent a large share of the GUF, more than 90 per cent. It is not possible to estimate the costs for scientific equipment at the two departments at NTNU and NLH.

The next table, Table 5, shows how direct funding is distributed on the different sources of funds.

Table 5
Direct funding on R&D at university departments of earth sciences by source of funds in 1995. (NOK million).

Institution	Source of funds: Business/ industry	Direct government funding: Research Council of Norway	Direct government funding: Other public funding	Other resources/ abroad/ own funds	Total
Univ. of Oslo	***5,9***	***9,2***	***0,9***	***2,2***	***18,2***
Department of Geology	5,5	3,5	-	1,4	10,4
Mineralogical Geological Museum	0,1	0,5	0,2	-	0,8
Paleontological Museum	0,3	0,0	-	-	0,3
Department of Geography	-	1,3	-	0,0	1,3
Department of Geophysics	-	3,9	0,7	0,8	5,4
Univ. of Bergen	***11,1***	***8,7***	***3,7***	***5,4***	***28,9***
Geophysical Institute	0,0	2,7	2,3	1,9	6,9
Department of Geology	2,4	5,6	0,2	1,0	9,2
Institute of Solid Earth Physics	8,6	0,4	1,3	2,4	12,8
Univ. of Trondheim (NTNU from 1.1.1996)	***5,2***	***2,6***	***0,2***	***0,0***	***8,0***
Department of Geology and Mineral Resources Engineering	2,8	1,5	0,2	-	4,5
The whole department of Petroleum Engineering	*10,0*	*4,0*	-	-	*14,0*
Geophysical part of this department	2,4	1,1	-	-	3,5
Univ. of Tromsø	***2,3***	***2,5***	***0,0***	***0,1***	***4,9***
Department of Geology	2,3	2,5		0,1	4,9
Agricultural University of Norway	***0,0***	***1,3***	***0,0***	***0,0***	***1,3***
The whole department of Soil and Water Sciences	*1,1*	*3,5*	*1,7*	*0,1*	*6,4*
Geological part of this department	-	1,3	-	-	1,3
Total	24,5	24,3	4,9	7,6	61,3

Source: NIFU

The two largest sources of funds are Business/industry and the Research Council of Norway. The share is 80 per cent, and the two sources contribute with approximately the same amount.

For natural sciences as a whole funds from Business/industry and the Research Council of Norway contribute with 76 per cent of total external funding. (Business/industry percentage amounts to 19 per cent, while the Research Council of Norway's contribution is almost 58 per cent.)

Table 6 shows current costs at the twelve departments by type of activity. In this context there is no way to estimate the distribution of activities for the geological parts of the two departments at NTNU and NLH.

Table 6
Distribution by type of activity at university departments of earth sciences in 1995.
Per cent, rounded off to closest 5.

	Type of activity			
Institution	Basic research	Applied research	Experi-mental develop-ment	Total
Univ. of Oslo				
Department of Geology	75	25	0	100
Mineralogical Geological Museum	90	10	0	100
Paleontological Museum	75	25	0	100
Department of Geography	70	20	10	100
Department of Geophysics	85	15	0	100
Univ. of Bergen				
Geophysical Institute	80	15	5	100
Department of Geology	50	40	10	100
Institute of Solid Earth Physics	40	40	20	100
Univ. of Trondheim (NTNU from 1.1.1996)				
Department of Geology and Mineral Resources Engineering	10	70	20	100
Department of Petroleum Engineering	0	100	0	100
Univ. of Tromsø				
Department of Geology	80	20	0	100
Agricultural university of Norway				
Department of Soil and Water Sciences	20	70	10	100

Source: NIFU

In the Frascati Manual[3] the three types of activities are defined as follow:

- **Basic research** is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations 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 object.
- **Experimental development** is systematic work, drawing on existing knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems or services; or to improving substantially those already produced or installed.

R&D personnel

The next two tables present figures on academic staff at the departments of earth sciences.

The first table shows the number of scientific personnel at the twelve departments in earth sciences and total academic staff in universities and university-level colleges and in natural sciences in 1993 and 1995. Figures for the state colleges are not included because they are not comparable from 1993 to 1995.

[3] The international guidelines for compiling R&D statistics is issued by OECD in the «Frascati Manual».

Table 7
Academic staff at university departments of earth sciences in relation to total academic staff at the universities in 1993 and 1995.

Category	1993	1995	Change in per cent
Total academic staff	8496	8755	3,0
Of which in natural sciences[1]	2001	2070	3,3
Of which in earth sciences[2]	296	298	0,7

Source: NIFU

[1] The figures on subject field for 1993 are corrected to 1995 standards.

[2] The 12 units covered in this paper.

Table 7 shows that 298 persons had scientific positions at the twelve departments in earth sciences in 1995. This is approximately 14 per cent of the total academic staff in natural sciences. The share in 1993 was close to 15 per cent.

Table 8
Academic staff at university departments of earth sciences by institution and professional rank in 1995.

Institution	Professor	Associate Professor	Other tenured positions	Total tenured personnel	Recruitment personnel	Externally paid researchers	Total
Univ. of Oslo	***23***	***25***	***4***	***52***	***38***	***15***	***105***
Department of Geology	11	9	0	20	17	4	41
Mineralogical Geological Museum	2	5	2	9	3	4	16
Paleontological Museum	2	2	0	4	1	0	5
Department of Geography	2	5	1	8	6	2	16
Department of Geophysics	6	4	1	11	11	5	27
Univ. of Bergen	***29***	***23***	***2***	***54***	***35***	***21***	***110***
Geophysical Institute	10	4	1	15	13	5	33
Department of Geology	12	10	1	23	16	9	48
Institute of Solid Earth Physics	7	9	0	16	6	7	29
Univ. of Trondheim (NTNU from 1.1.1996)	***13***	***6***	***1***	***20***	***26***	***2***	***48***
Department of Geology and Mineral Resources Engineering	12	4	0	16	18	2	36
The whole department of Petroleum Engineering	*8*	*5*	*1*	*14*	*23*	*7*	*44*
Geophysical part of this department	1	2	1	4	8	0	12
Univ. of Tromsø	***4***	***6***	***1***	***16***	***9***	***3***	***28***
Department of Geology	4	6	1	16	9	3	28
Agricultural University of Norway	***3***	***2***	***0***	***5***	***2***	***0***	***7***
The whole department of Soil and Water Sciences	*10*	*9*	*1*	*20*	*12*	*1*	*33*
Geological part of this department	3	2	0	5	2	0	7
Total 1995	72	62	8	147	110	41	298
Total 1993	67	58	11	136	126	34	296

Source: NIFU

Table 8 shows the professional rank of the academic staff at the departments of earth sciences in 1995.

The total tenured personnel share of total academic staff was close to 50 per cent in 1995. Of the remaining personnel the recruitment personnel (fellowship holders) amounts to 72 per cent, the rest is externally paid researchers (contract researchers). The University of Bergen covers 37 per cent of the total personnel in earth sciences. Together with the University of Oslo, the University of Bergen covers 72 per cent of the academic staff in earth sciences.