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Research and development in Finland 1989

16.9.1991

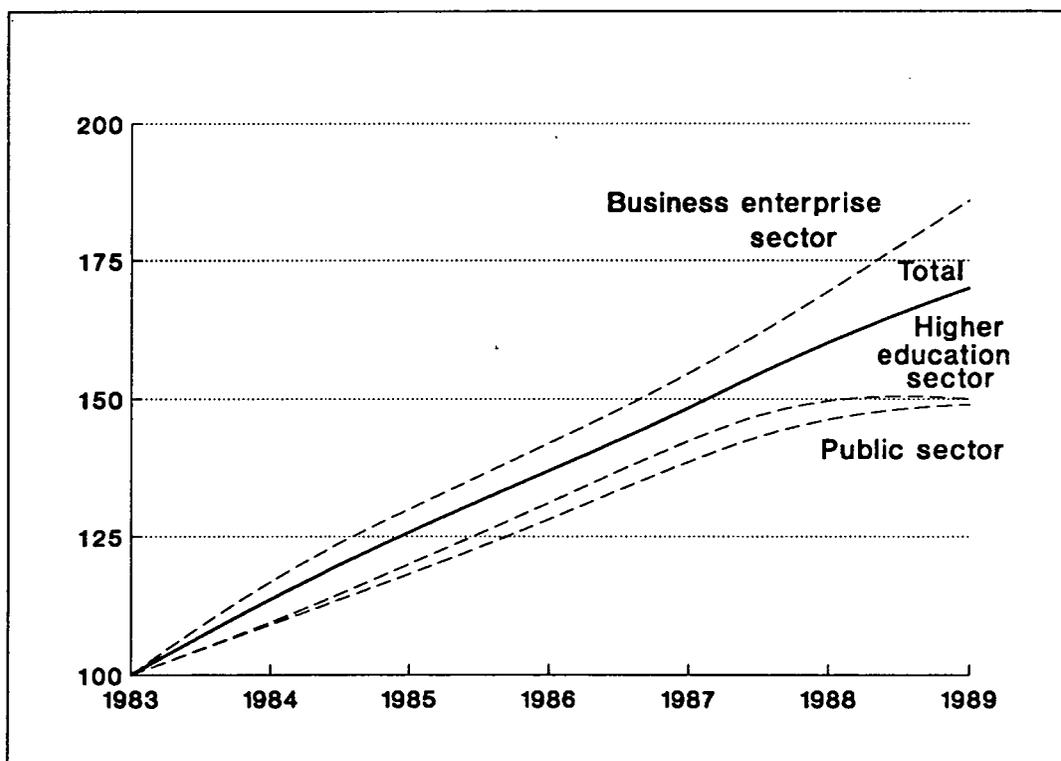


Figure 1. Research and development expenditure, 1983 – 1989 (1983 = 100)

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1. Overall trends in research and development

R & D expenditure 1.8 % of GDP in 1989

The share of R & D expenditure in GDP is used as a measure of developments in the volume of outlays on research and development in both domestic and international comparisons. In Finland, this share has grown steadily from 0.9 % in 1971 to 1.8 % in 1989. In the late 1980s,

the growth rate slowed a little. In 1991, the share of R & D expenditure in GDP is likely to amount to 2.0 %, as a result of a forecast fall in GDP and a simultaneous increase in R & D expenditure.

Table 1. Estimate of research and development expenditure, 1983 – 1991, (in current prices, FIM mill.)

Year	Business enterprise sector		Public sector ¹⁾		Higher education sector		Total		Share in GDP %
	FIM mill.	%	FIM mill.	%	FIM mill.	%	FIM mill.	%	
1983	2 060	55.7	791	21.4	845	22.9	3 696	100.0	1.34
1984	2 638	58.0	936	20.6	976	21.4	4 550	100.0	1.47
1985	3 082	58.7	1 069	20.4	1 097	20.9	5 248	100.0	1.56
1986	3 512	58.9	1 215	20.4	1 234	20.7	5 961	100.0	1.65
1987	4 002	58.9	1 389	20.4	1 401	20.7	6 792	100.0	1.73
1988	4 709	59.8	1 575	30.0	1 589	20.1	7 873	100.0	1.76
1989	5 499	61.6	1 701	19.1	1 726	19.3	8 926	100.0	1.80
1990	6 158	62.3	1 846	18.7	1 878	19.0	9 882	100.0	1.88
1991	6 651	61.6	2 062	19.1	2 076	19.3	10 789	100.0	2.00

Estimation method: All data for 1983, 1987 and 1989 are based on surveys on the funding of research carried out by the Central Statistical Office. Business sector data for 1984 and 1985 are based on surveys; other data are estimates. All data for 1986, 1988, 1990 and 1991 are estimates.

Developments in R & D expenditure in the various sectors have been estimated by raising the R & D expenditure figures obtained from surveys by means of growth coefficients, which in the case of the business enterprise sector have been calculated from data in the Bank of Finland's investment inquiry. Developments in the other sectors have been estimated on the basis of the analysis of central government budget appropriations for research carried out by the Academy of Finland. The estimated share in GDP is based on data of the Central Statistical Office.

¹⁾ Also includes private non-profit sector.

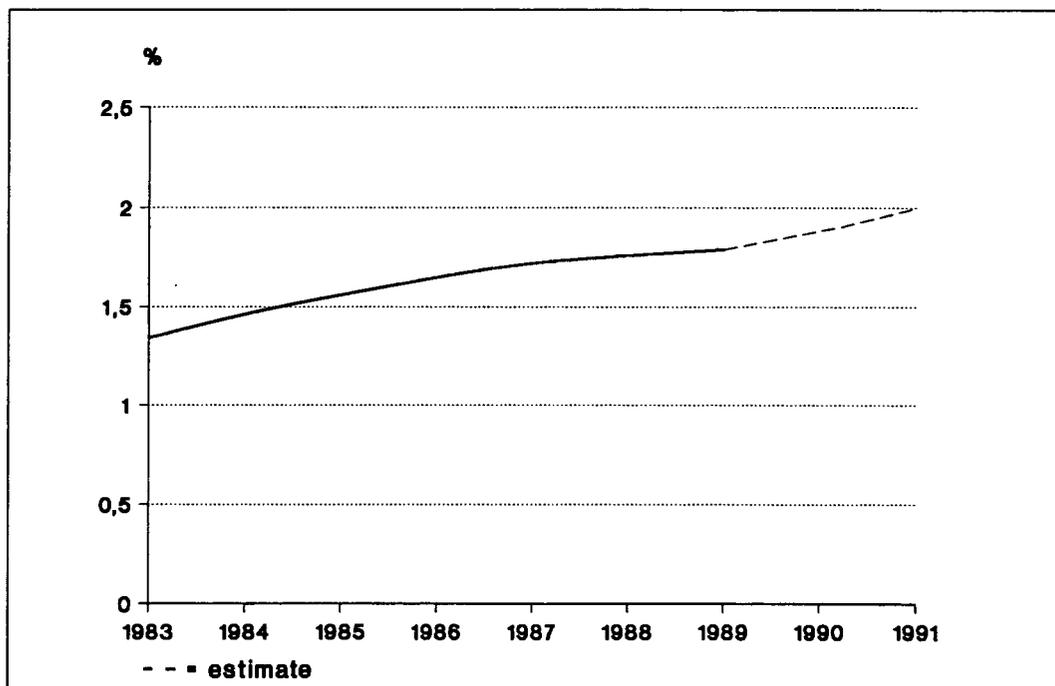


Figure 2. Share of R & D expenditure in GDP, 1983 – 1991

Real growth of R & D expenditure about 9 % per year

Between 1983 and 1989, R & D expenditure increased in real terms by about 9 % a year on average. A total of FIM 8.9 billion was spent on R & D in 1989. The average real annual rate of growth of R & D expenditure in the period from 1983 to 1989 was highest in the business enterprise sector, at about 11 %. In the public sector and universities, the average real annual rate of growth over the same period was approximately 7 %. Outlays on R & D are estimated to reach FIM 10.7 billion in 1991.

GDP share of R & D expenditure in Finland at the OECD average level

In 1987, the share of R & D expenditure in GDP in the OECD countries amounted to 1.7 % on average. In countries with extensive research activities, the share exceeded 2.0 % in all cases. However, growth in the R & D share also slowed in these countries in the late 1980s, with the exception of Japan and France.

In the United States, a large part of R & D expenditure is accounted for by military research. If these outlays are excluded, the share of R & D expenditure in GDP falls to about 2.0 %. Between 1987 and 1989, the fastest growth in R & D expenditure in the OECD countries took place in Japan, where the share of OECD total R & D expenditure grew by 1.2 percentage points.

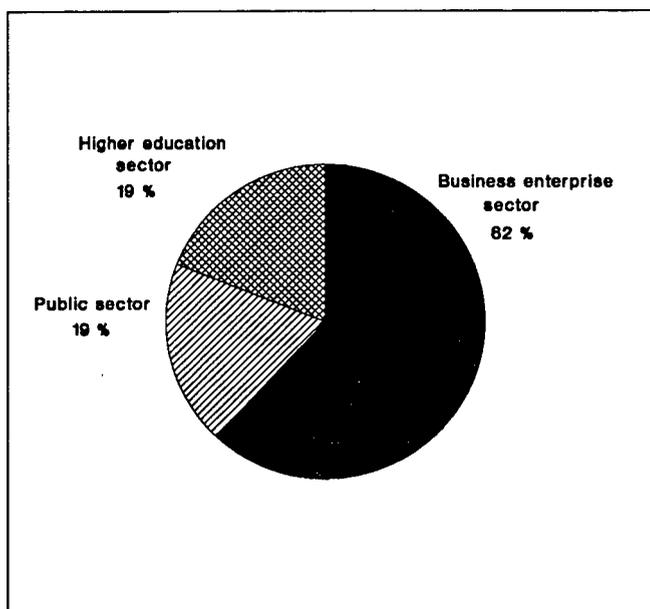


Figure 3. Distribution of R & D expenditure by sectors, 1989

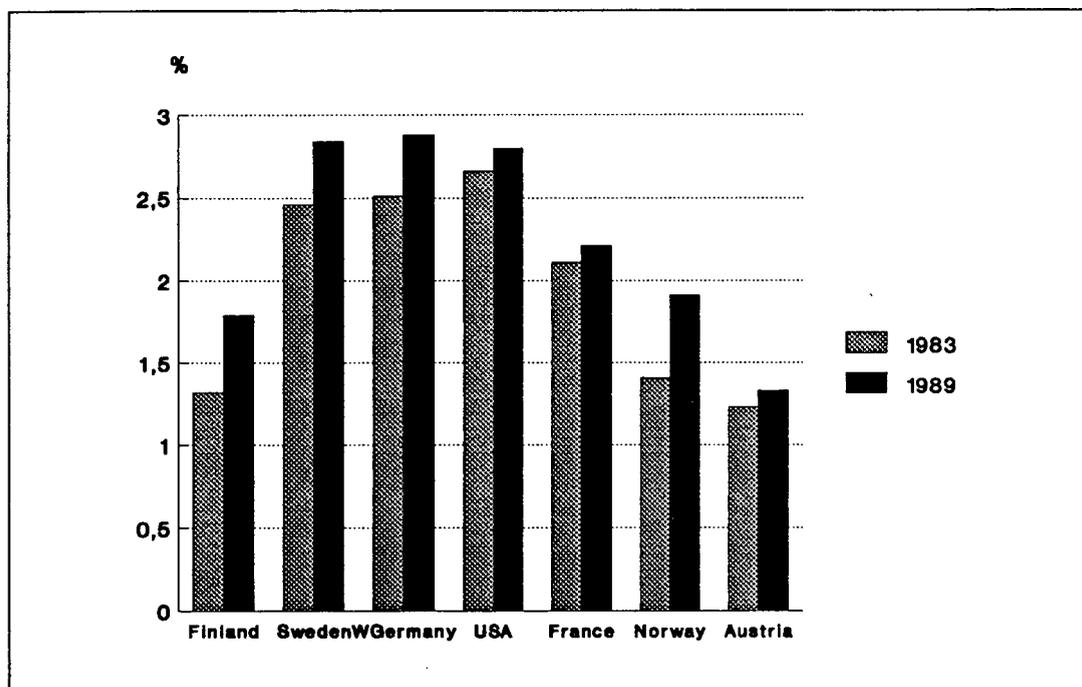


Figure 4. Share of R & D expenditure in GDP in selected OECD countries, 1983 and 1989

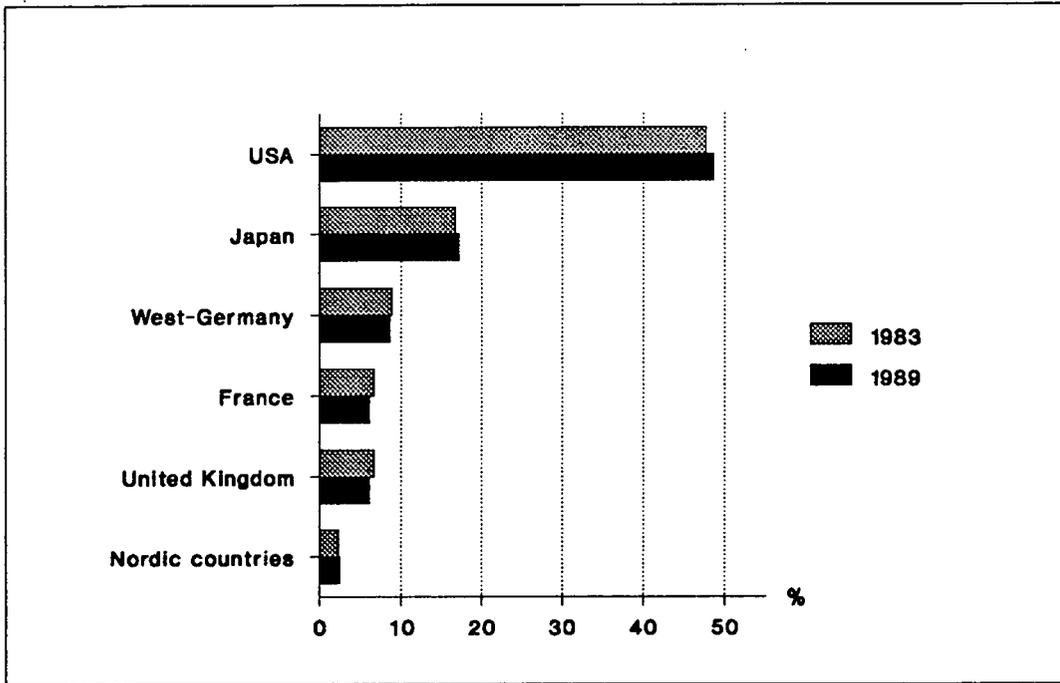


Figure 5. Share of selected countries in total R & D expenditure in the OECD area, 1983 and 1989

Growth of R & D spending by the business enterprise sector halted in Sweden and Norway

A comparison of the Nordic countries for 1989 shows that the GDP share of Finland's R & D expenditure is clearly lower than Sweden's (GDP share 3.0 %) but is close to

Norway's (GDP share 1.91 %). Between 1987 and 1989, R & D expenditure by the business enterprise sector fell in real terms in Sweden and Norway. In Sweden, the real average annual growth of R & D expenditure was negative in all sectors between 1987 and 1989 (see Table 2).

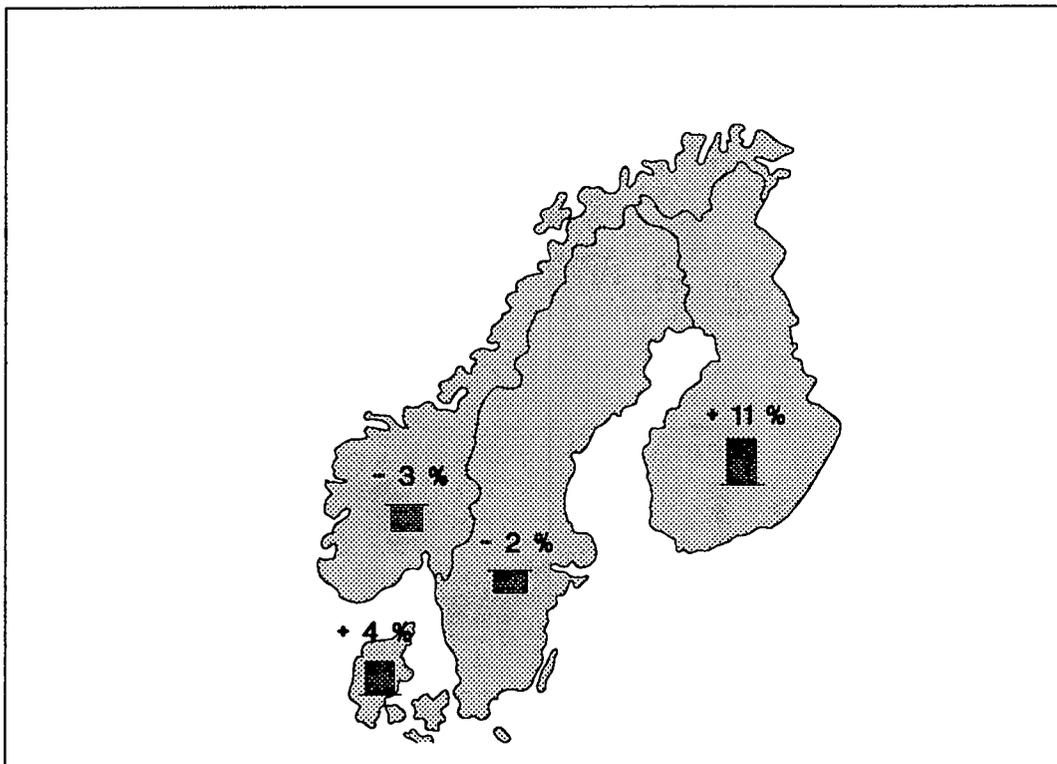


Figure 6. Average annual real growth of R & D expenditure in the business enterprise sector in the Nordic countries between 1987 and 1989

Table 2. R & D expenditure in the Nordic countries by sectors, 1989

	Business enterprise sector	Average real annual growth, %	Public sector	Average real annual growth, %	Higher education sector	Average real annual growth, %	Total	Average real annual growth, %
	FIM mill.		FIM mill.		FIM mill.		FIM mill.	
Finland	5 499	11	1 701	7	1 678	7	8 878	9
Sweden ¹⁾	14 920	- 2	960	- 3	6 670	- 1	22 550	- 2
Norway	4 070	- 3	1 390	9	1 730	7	7 190	1
Denmark	3 850	4	1 600	4	1 970	7	7 420	5

¹⁾As regards Sweden's R & D expenditure in 1989, the figures for the higher education sector and total R & D expenditure are estimates.

The public sector funded about 38 % of R & D in 1989

In addition to actual outlays on research and development, one can examine the sources of funds used for financing R & D activities. In 1989, the public sector financed approximately 38 % of all research expenditure. The corresponding share from domestic companies was about 59 %, while the share of other sources (including funds and foundations, foreign finance) was about 3 %.

Share of the Greater Helsinki area in R & D expenditure falls

In 1989, approximately 39 % of all outlays on R & D occurred in the Greater Helsinki area, i.e. six percentage points less than in 1987. The share of the entire province of Uusimaa nevertheless increased from 52 % to 55 % between 1987 and 1989. Analysed by sectors, concentration is highest in the public sector, where about 65 % of R & D expenditure occurred in the Greater Helsinki area. In the business enterprise sector, the concentration of R & D expenditure in the Greater Helsinki area fell by about three percentage points between 1987 and 1989. The major part, 43 %, of R & D expenditure by universities took place in the Greater Helsinki area. Analysed by provinces, only Häme and Oulu had a share of more than 10 % in the higher education sector.

Table 3. Research expenditure by province and sector, 1989

Province	Business enterprise sector	Public sector	Higher education sector	Total
	%			
Uusimaa - of which	50.7	66.2	42.7	55.2
Greater Helsinki area ¹⁾	35.6	64.7	42.6	39.0
Turku-Pori	14.0	23	14.8	10.8
Åland	0.0	0.2	-	0.0
Häme	11.3	11.9	11.8	10.4
Kymi	6.0	0.6	2.2	3.9
Mikkeli	1.4	0.8	0.4	1.0
Northern Carelia	0.6	1.3	3.2	1.1
Kuopio	1.8	2.5	4.1	2.1
Central Finland	3.3	4.0	6.9	3.7
Vaasa	4.6	1.2	1.0	3.0
Oulu	5.3	5.2	12.0	5.9
Lappi	1.0	3.6	0.9	2.7
Unspecified	-	0.3	0.0	0.2
Total	100.0	100.0	100.0	100.0
Expenditure (FIM mill.)	5 499	1 701	1 726	8 925
Share (%)	62	19	19	100

¹⁾Helsinki, Espoo, Vantaa, Kauniainen

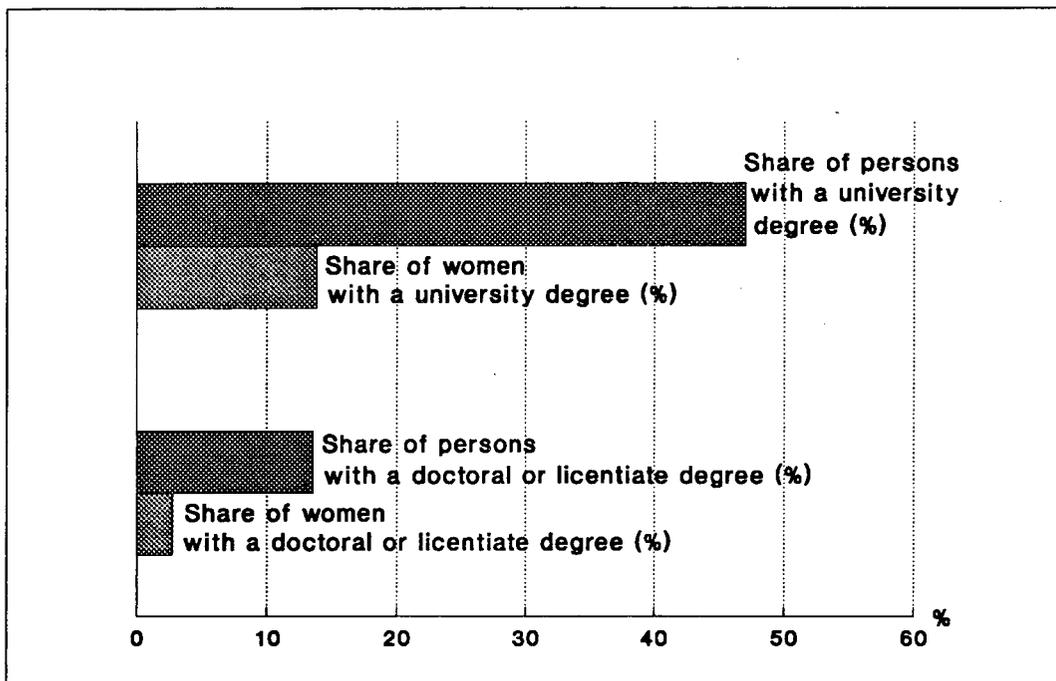


Figure 7. Share of persons with a university degree in total research staff, 1989

Research staff numbered about 38 450 in 1989

The number of persons engaged in R & D work was approximately 30 % higher in 1989 than in 1983. Women accounted for about 33 % of all research staff. Analysed by sectors, the share of women was highest, 42 %, in the public sector, was 40 % in universities and lowest, 24 %, in the business enterprise sector.

In 1989, about 21 % of all persons under 65 years of age with a university degree were engaged in R & D work, of whom 29 % were women. About 48 % of persons aged under 65 with a doctoral or licentiate degree were engaged in R & D. Of this group about 20 % were women.

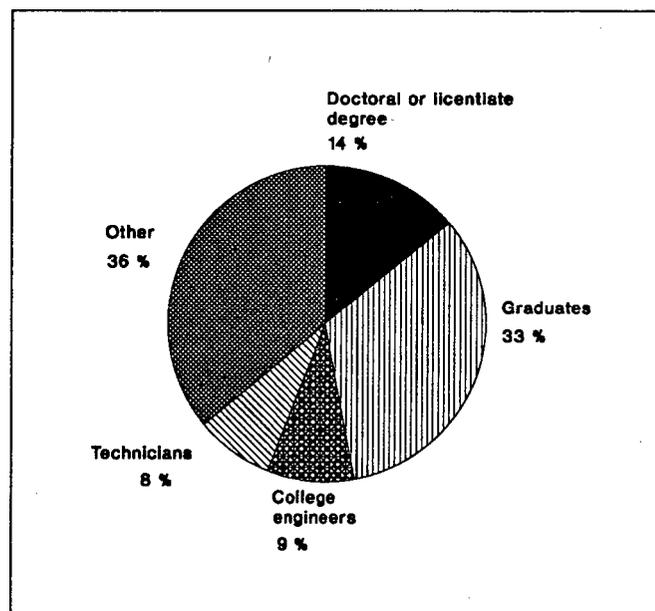


Figure 8. Research staff according to education, 1989

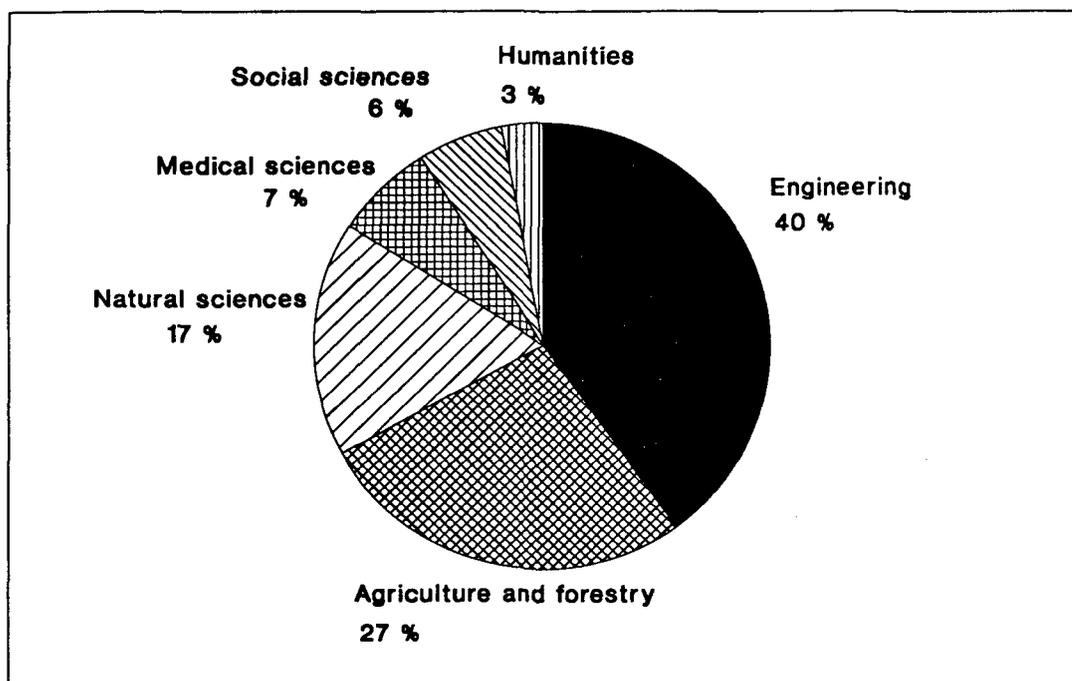


Figure 9. Research man-years by scientific fields in the public enterprise sector, 1989

Number of research man-years has increased by about 6 % a year on average since 1983

A total of approximately 28 516 research man-years were worked in all sectors in 1989. Of the total number of man-years 51 % were worked in the business enterprise sector, 23 % in the public sector and 26 % in the university sector.

In the business enterprise sector, a total of 14 536 research man-years were worked in 1989. The share of persons with a university degree in total man-years worked in this sector grew steadily from 32.1 % in 1979 to 35.4 % in 1989. The share of persons with doctoral or licentiate degrees in total man-years was at its highest level in the decade in 1989, i.e. 4.4 %.

In 1989, a total of 6 619 research man-years were worked in the public sector. Between 1987 and 1989, the share of persons with a university degree in total man-years worked in the public sector increased from 45.5 % to 51.3 % and the share of man-years worked by persons with a doctoral or licentiate degree from 11.2 % to 14.6 %. Analysed by scientific fields, most man-years were worked in the technical field, about 40 %, followed by agricultural and forestry 27 %, and natural sciences, 17 %.

The number of research man-years worked in universities totalled some 7 362 in 1989. The average annual growth of man-years between 1983 and 1989 was about 5 %.

2. Research and development in the business enterprise sector

Business outlays on R & D at about FIM 5.5 billion

Finnish companies spent FIM 5 499 million on R & D in 1989. Between 1983 and 1989, business outlays on R & D grew by about 11 % a year on average. The share of industry (including mining and quarrying, energy and water supply) was FIM 4 539 million.

About 9.0 % of companies' R & D expenditure in 1989 was funded externally (including loans and grants). The share of loans and grants provided by the Technology Development Centre, the Finnish National Fund for Research and Development and the Regional Development Fund was about 5 %.

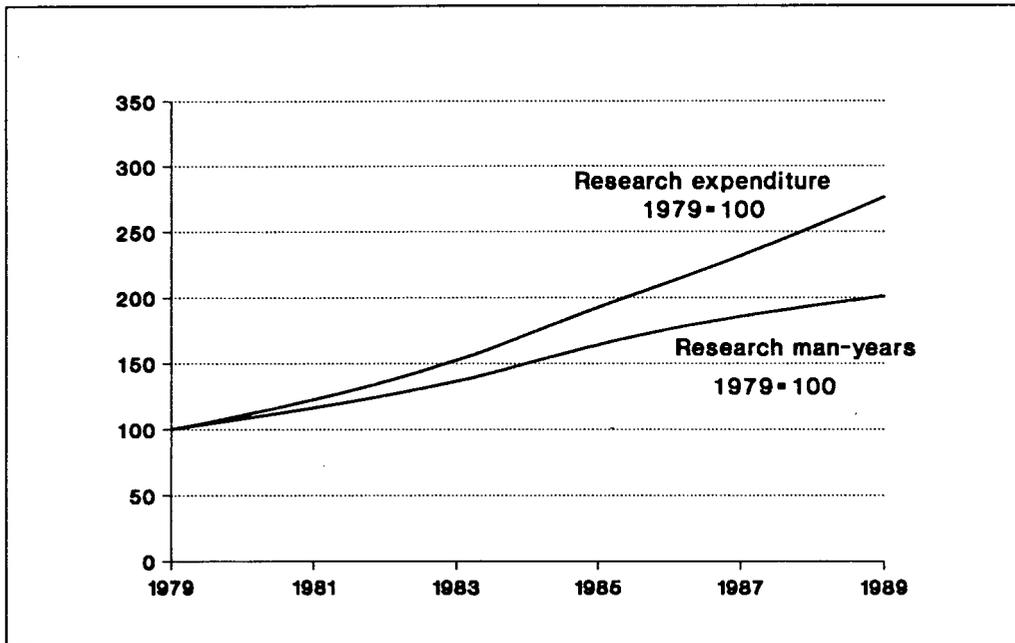


Figure 10. R & D expenditure and research man-years in the enterprise business sector, 1979 - 1989

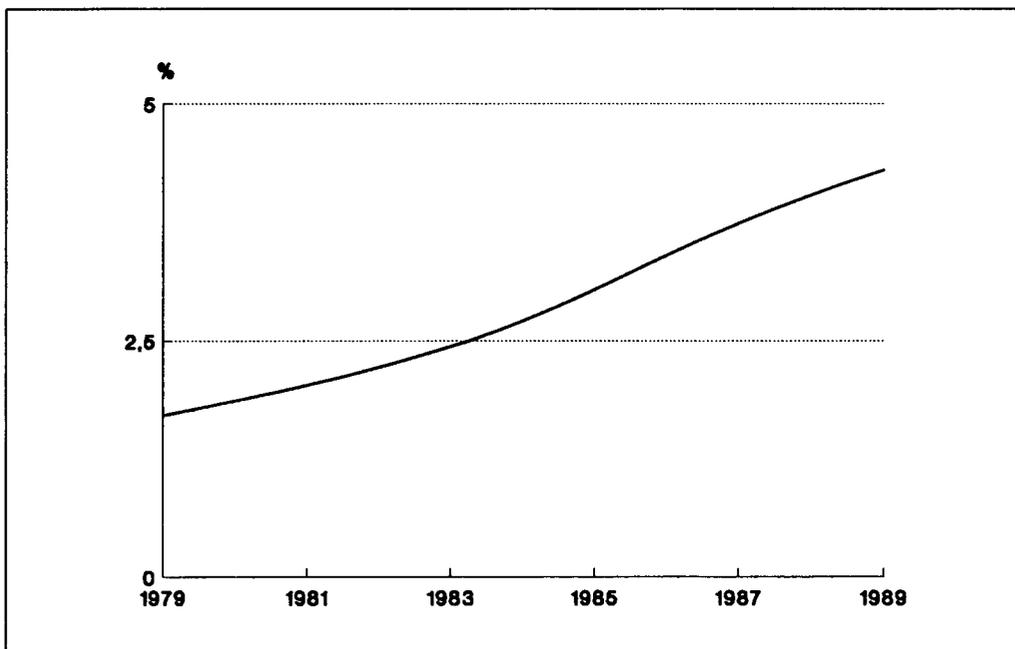


Figure 11. Share of business enterprise sector's R & D expenditure in value added, 1979 - 1989

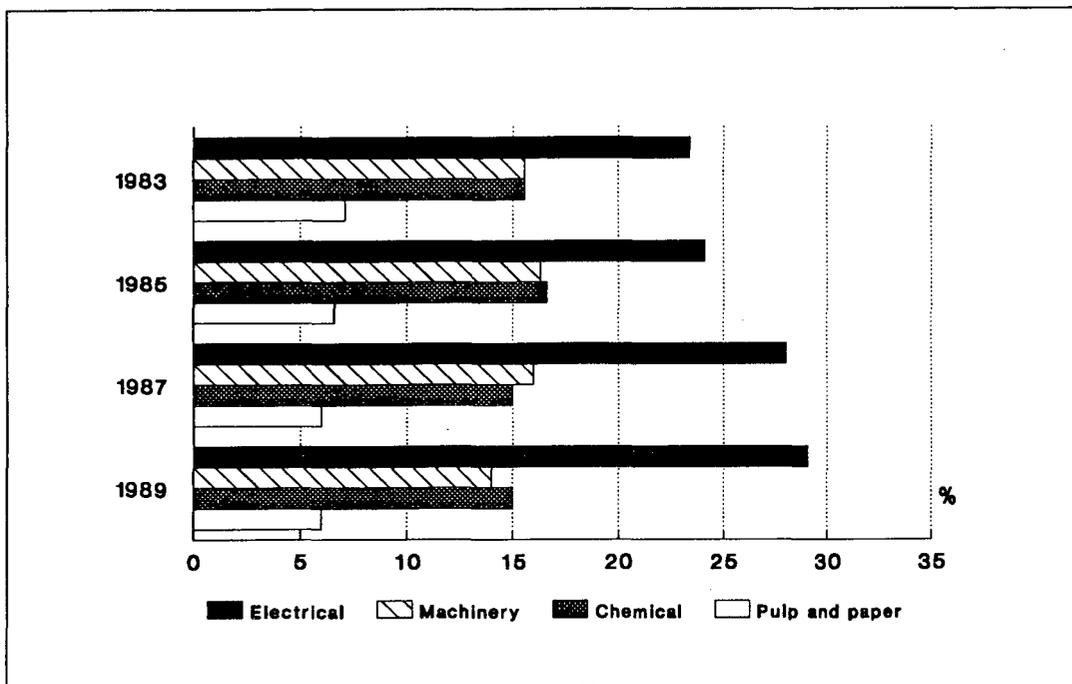


Figure 12. Business enterprise sector's R & D expenditure by product groups, 1983 and 1989

Growing share of R & D expenditure in value added

The share of R & D expenditure in value added increased every year in the 1980s. In 1989, the share of industry's R & D expenditure in value added was 4.3 % and the corresponding figure for manufacturing was 4.7 %. In 1987, the respective shares were 3.8 % for total industry and 4.1 % for manufacturing.

The share of R & D outlays in the total turnover of the

business enterprise sector amounted to 1.6 % in 1989. Analysed by industries, the share of R & D expenditure in manufacturing turnover was highest for electrical products (8.7 %), and lowest for publishing and printing (0.3 %).

Ten largest companies account for 50.0 % of total business outlays on R & D

R & D is heavily concentrated. In all, 1 006 companies reported that they carried on R & D activities in 1989.

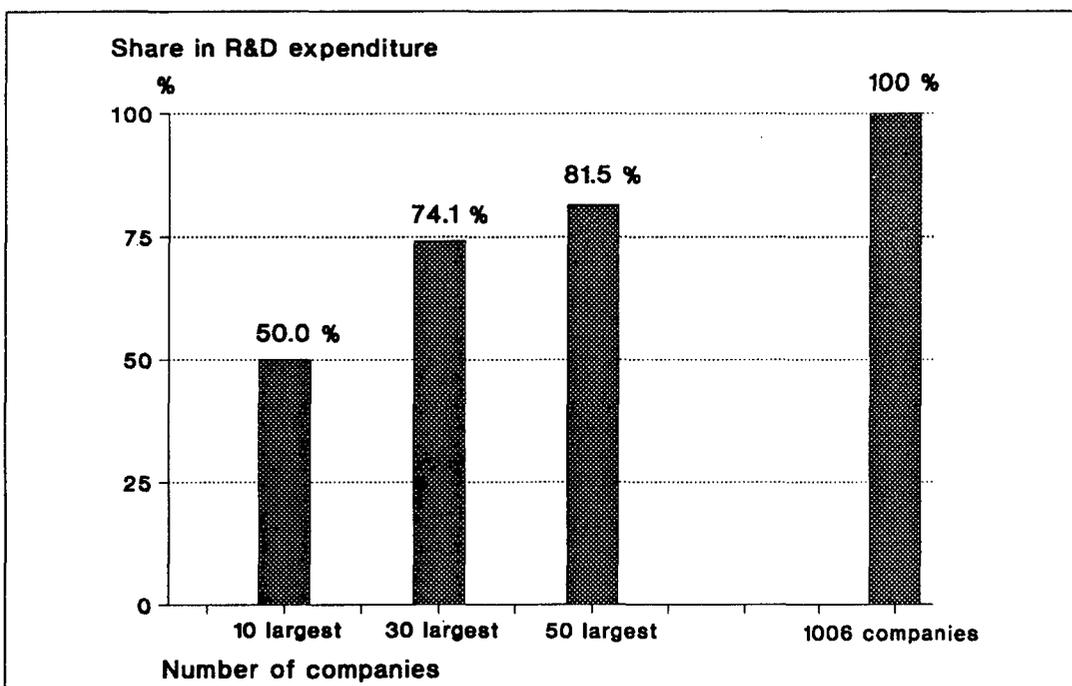


Figure 13. Share of companies with largest R & D expenditure in total R & D expenditure by the business enterprise sector, 1989

3. Research and development in the public sector

Expenditure on R & D by the public sector (including central government administration, other public institutions and the private non-profit sector) amounted to FIM 1 701 million in 1989, or approximately 19 % of all R & D outlays.

About 7.5 % of R & D expenditure by the public sector was in administrative services other than that of the central

government, i.e. other public institutions (4.8 %) and the private non-profit sector (2.7 %).

More than half of the R & D outlays of the public sector in 1989 was spent in the administrative field of the Ministry of Trade and Industry. The relative share of the Ministry of the Environment in R & D expenditure by the public sector increased from 3.4 % to 5.2 % between 1987 and 1989.

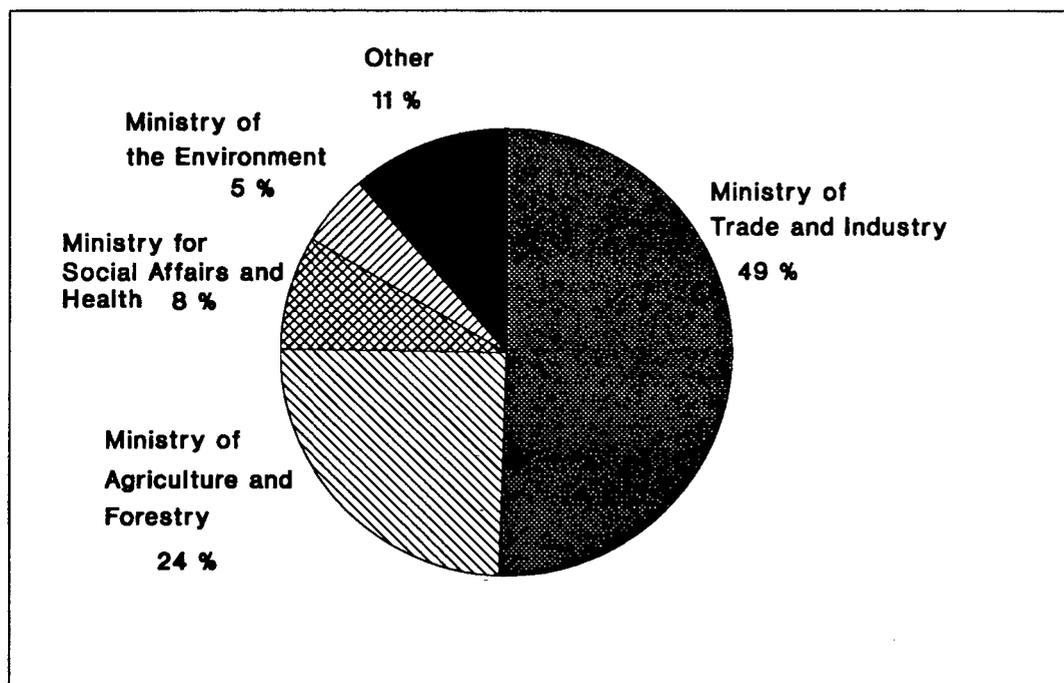


Figure 14. R & D expenditure by administrative field, 1989

4. Research in the higher education sector

R & D expenditure by universities totalled FIM 1 726 million in 1989. Real outlays grew by about 7 % a year on average between 1983 and 1989.

Research expenditure by universities is mainly funded by grants to universities allocated in the central government budget. In 1989, such funds amounted to FIM 1 095.3 million, or about 63 %, of spending on research. Extra-bud-

etary external funding amounted to FIM 630.3 million, or about 37 %. The figure for total external funding in 1989 probably falls short of the actual amount because of problems in data collection (see Definitions and data). The most important single sources of funding in the public sector in 1989 included the Academy of Finland (FIM 190 million) and the Technology Development Centre (FIM 70 million).

5. Definitions and data

The Central Statistical Office has compiled statistics on research and development biannually since 1971. The statistics are based on data obtained from companies, the public sector and universities.

Research and development (R & D) refers to systematic activity aimed at increasing knowledge and the use of knowledge for finding new applications. Research and development includes basic research, applied research and development work.

The statistics are compiled in accordance with recommendations issued by the OECD and refer only to research and development in the home country. The recommendations have been published in the manual, OECD: the Measurement of Scientific and Technical Activities, Paris 1981. Statistics are compiled in compliance with these recommendations in all OECD countries. Every second other year, the OECD collects detailed data on research and development activities in member countries. These are published both in the form of summary statistics and analytical reports of various kinds. The international R & D data in this publication are based on OECD data.

The data on research and development activities in the business enterprise sector have been obtained by means of a questionnaire (most recently in 1989). More detailed information on the survey appear in the publication, Research and development in the business enterprise sector in 1989 (Education and Research 1990:24) and the appended tables.

The data on research and development activities in the public sector have been obtained by means of a question-

naire (most recently in 1989). More detailed definitions and information on the survey appear in the tables on research and development which is available only in Finnish to this publication. Data on research activities in universities have been obtained mainly from administrative data sources and from estimates based on other material relating to universities. The estimation of the share of research is based on the survey on the use of time by university staff carried out in 1983. Data on the number of staff have been obtained from the 1989 personnel payroll data system and from the Academy of Finland.

Data on external research funding has been obtained mainly from the 1989 database on the monitoring of activities of universities. The statistics on external funding probably do not report the full extent of such financing owing to data collection problems in the 1989 database. Data on building investment and on the operating and acquisition costs of buildings paid by the National Board of Building have been obtained from the Board in question. More detailed information on the collection of data are published in the tables on research and development activities appended to this publication.

The compilation of statistics on research and development is hampered by the differing interpretation of the definition of research and development activities in units supplying data. In the instructions for completing the questionnaires it is only possible to give general guidelines concerning the determination of research and development. How the definition is applied in practice depends on the supplier of data.



Research and development in Finland 1989

Education and research
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publication Statistical reports
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The data in this publication are based on a questionnaire sent by the Central Statistical Office to companies, the public sector and universities and on data on universities obtained from other sources. More detailed definitions and results appear in the Tables on research and development (product no. 9863).

SCIENCE AND TECHNOLOGY (Publications in English)

Education and research series	1991:1 1991:5	R&D in the Business Enterprise Sector in Finland 1989 Research and Development in Finland 1989
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