TECHNOLOGY DATA – 1997 C QUEEN 0 180 .C2 S3 1997

Industry Industrie Canada Canada

IC

Canadä

SCIENCE AND TECHNOLOGY DATA

Industry and Science Policy Sector Industry Canada Telephone: (613) 993-7589 Facsimile: (613) 996-7887 E-mail: skahen.al@ic.gc.ca Web site: http://strategis.ic.gc.ca/S-Tinfo December 1997

NOV - 9 2000

Inclustrie Canada Essilothèque - Queen

© Her Majesty the Queen in Right of Canada (Industry Canada) 1997 Cat. No. C1-4/1997 ISBN 0-662-63289-3 51690B



Contents

Abbreviations

National

- Canada's Gross Domestic Expenditure on R&D (GERD), 1986–1997
- 2 GERD by Major Sources of Funds, 1975–1997
- 3 Expenditures on R&D, by Performing and Funding Sectors, 1997
- 4 Expenditures on R&D, by Region and Funding Sector, 1995

Government

- 5 Federal Budgetary Expenditures on S&T and R&D, 1987–1997
- 6 Federal S&T Expenditures, by Major Departments or Agencies, Percentage Change, 1989–1993 and 1993–1997
- 7 Federal Expenditures on R&D, by Performer, 1993 and 1997
- 8 Federal S&T Expenditures, by Socio-economic Objective, 1996–1997
- 9 Manufacturing Firms Conducting R&D that Claim Tax Credits

Contents (cont'd)

Business Enterprise

- 10 Business Expenditures on R&D (BERD), by Source of Funds, 1986–1997
- 11 Industrial R&D Expenditures, by Major Groups, 1986–1997
- 12 Service Industries Use of Selected Technologies by Firm Size
- 13 Distribution of Innovation Costs by Firm Size
- 14 Impediments to Innovation in Manufacturing Firms
- 15 Significance of Innovation and Employment Size

Higher Education

- 16 Higher Education Expenditure on R&D (HERD), 1986–1997
- 17 HERD by Major Sources of Funds, 1986–1997
- 18 Higher Education R&D Expenditures, by Major Fields and Source of Funds, 1995–1996
- 19 University Expenditures, Total and Sponsored Research (SR)

Contents (cont'd)

International

- 20 Selected International Comparisons, 1995
- 21 Manufacturing R&D Intensity of G7 Countries by Technology Groups
- 22 Industry Research and Development
- 23 Research Papers, Selected Countries, 1992–1996
- 24 Net Enrolment Rates in University Education by Age Group, 1994
- 25 University Graduates by Field of Study, 1994

Employment

- 26 Employment Growth by Knowledge Intensity, Total Business Sector, 1971–1996
- 27 High-tech Employment in Canada's Major Urban Centres, 1990 and 1996
- 28 Employment Growth by Educational Attainment, 1990–1996
- 29 Workplace Computer Use by Education, 1994
- 30 Skill Effects of Computer-based Technology, Percentage Distribution of Job Types, 1992–1994

31 References

Abbreviations

BE	Business enterprise
BERD	Business expenditure on research and development
GDP	Gross domestic product
GERD	Gross domestic expenditure on research and development
HERD	Higher education expenditure on research and development
HRDC	Human Resources Development Canada
MSTI	Main science and technology indicators
NSE	Natural sciences and engineering
OECD	Organisation for Economic Co-operation and Development
PNP	Private non-profit organization
PRO	Provincial research organization
R&D	Research and development
RSA	Related scientific activities
SR	Sponsored research
SSH	Social sciences and humanities
S&T	Science and technology

A publication of this type is a snapshot, freezing information at a particular point in time. New data are constantly becoming available. Data in tables and figures may not necessarily add to the totals shown due to rounding.

Canada's Gross Domestic Expenditure on R&D (GERD), 1986-1997



Source: Statistics Canada. Note: 1997 GERD/GDP value and 1997 constant dollar value are Industry Canada estimates.

GERD by Major Sources of Funds, 1975–1997



2

Expenditures on R&D, by Performing and Funding Sectors, 1997

Funder	Federal	Provincial	PRO BE		University	PNP	Total	Distribution	
				(\$ million:	5)			(%)	
Federal	1 505	1	5	518	785	26	2 840	21	
Provincial	-	169	39	86	347	21	662	5	
PRO	-		-	-	-	-	-	-	
BE	20	-	23	6 298	296	29	6 666	50	
University	-	-	-	-	1 117	-	1 117	8	
PNP	-	-	-	-	263	73	336	3	
Foreign	-	-	6	1 725	20	11	1 762	13	
Total Share of	1 525	170	73	8 627	2 828	160	13 383	100	
total (%)	11	1	1	64	21	1	100		

Source: Statistics Canada.

Expenditures on R&D, by Region and Funding Sector, 1995



Source: Statistics Canada.

	reuei	ai Duu	yetary	ryhen	ulturea	5 011 30	xi anu	nau,	1307-1	337	
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
		(\$ millions)									
S&T	4 505	4 816	5 063	5 472	5 792	5 762	5 934	5 786	5 632	5 680	5 102
R&D	2 685	2 906	3 086	3 273	3 455	3 556	3 646	3 635	3 452	3 404	3 069
					(Consta	ant 1986 \$	millions)				
S&T	4 303	4 394	4 406	4 618	4 751	4 669	4 759	4 576	4 4 17	4 399	3 904*
R&D	2 564	2 652	2 686	2 762	2 835	2 882	2 924	2 894	2 708	2 637	2 348*
				(Sha	re of fede	ral progra	m spendir	ıg (%))			
S&T	4.7	4.8	4.9	5.0	5.0	4.7	4.9	4.9	5.0	5.4	4.8
R&D	2.8	2.9	3.0	3.0	3.0	2.9	3.0	3.1	3.1	3.2	2.9

Federal Rudgetary Expenditures on S&T and R&D 1987_1997

Source: Statistics Canada and Department of Finance. * Industry Canada estimate.

Federal S&T Expenditures, by Major Departments or Agencies, Percentage Change, 1989–1993 and 1993–1997



Source: Statistics Canada.

Federal Expenditures on R&D, by Performer, 1993 and 1997



Source: Statistics Canada.

Federal S&T Expenditures, by Socio-economic Objective, 1996–1997



Source: Statistics Canada.

Manufacturing Firms Conducting R&D that Claim Tax Credits



Source: Statistics Canada.

Business Expenditures on R&D (BERD), by Source of Funds, 1986-1997



Source: Statistics Canada. Note: 1997 BERD/GDP value is an Industry Canada estimate.

Industrial R&D Expenditures, by Major Groups, 1986-1997



Source: Statistics Canada.

Service Industries Use of Selected Technologies by Firm Size

Personal computers Computerized financial systems Wireless communications E-mail Computerized inventory control Desktop publishing Internet Electronic funds transfer External databases Computerized order entry Total quality management Business process re-engineering



Usage rate (%)

Source: Industry Canada.

Distribution of Innovation Costs by Firm Size



Impediments to Innovation in Manufacturing Firms

Lack of skilled personnel

Lack of information on technologies Lack of information on markets

Lack of external technical services

Barriers to interfirm cooperation

Barriers to university cooperation

Government standards



Source: Statistics Canada.

Significance of Innovation and Employment Size



15

Higher Education Expenditure on R&D (HERD), 1986–1997



Note: 1997 constant dollar HERD value is an Industry Canada estimate.

HERD by Major Sources of Funds, 1986-1997



Higher Education R&D Expenditures, by Major Fields and Source of Funds, 1995–1996



18

University Expenditures, Total and Sponsored Research (SR) (constant 1986 dollars)



19

Selected International Comparisons, 1995

	GERD)/GDP		GERD per Capita	
	Total	Civil	GERD		
	((%)	(US\$ billions)	(US\$)	
Sweden	3.02	2.8	5.0	565	
Japan	2.78	2.7	76.0	607	
United States	2.58	2.1	179.1	681	
France	2.34	2.0	27.1	466	
Finland	2.32	2.3	2.1	413	
Germany	2.28	2.2	38.1	467	
United Kingdom	2.05	1.7	21.4	365	
Netherlands*	2.04	2.0	5.9	381	
Denmark	1.82	1.8	2.1	393	
Canada	1.61	1.6	10.0	338	
Italy	1.14	1.1	12.7	222	

Source: OECD, MSTI, May 1997. *1994 data.

Manufacturing R&D Intensity of G7 Countries by Technology Groups (1994 or latest year)



21



Industry Research and Development

Source: OECD.



Research Papers, Selected Countries, 1992–1996

Source: The Scientist.

30 Age group 26-29 18-21 22-25 25 Percentage of age group 20 15 10 5 0 Sweden United Kingdom Canada **United States** France Germany Netherlands Korea

Net Enrolment Rates in University Education by Age Group, 1994

Source: OECD, Education at a Glance.

University Graduates by Field of Study, 1994



Source: OECD, Education at a Glance.

Employment Growth by Knowledge Intensity, Total Business Sector, 1971-1996



26

High-tech Employment in Canada's Major Urban Centres, 1990 and 1996



High tech as a percentage of total employment



Employment Growth by Educational Attainment, 1990–1996

Source: Statistics Canada.

Workplace Computer Use by Education, 1994



Skill Effects of Computer-based Technology, Percentage Distribution of Job Types, 1992–1994



30

References

Finance Canada, Budget 1997, Budget Plan, February 18, 1997. Finance Canada, Fiscal Reference Tables, October 1997. Gera, Surendra, Industry Canada, and Philippe Massé, Human Resources Development Canada, Employment Performance in the Knowledge-based Economy, December 1996. Industry Canada, "The Use of Technologies," Strategis Web site http://strategis.ic.ca.gc/SSG/it03473e.html Organisation for Economic Co-operation and Development, ANBERD, Business Enterprise R&D Expenditures, 1997 edition. Organisation for Economic Co-operation and Development, Education at a Glance. Organisation for Economic Co-operation and Development, Main Science and Technology Indicators, May 1997. Organisation for Economic Co-operation and Development, The OECD STAN Database for Industrial Analysis, 1997 edition. Scotiabank, "Focus on Canada's Major Urban Centres," Provincial Pulse, August 25, 1997. Statistics Canada, Education in Canada, 1996, Cat. No. 81-229-XPB.

Statistics Canada, "Federal Government Expenditures on Scientific Activities, 1997-98," Science Statistics, Cat. No. 88-001-XPB, Vol. 21, No. 4, May 1997. Statistics Canada, "Industrial Research and Development, 1993 to 1997," Science Statistics, Cat. No. 88-001-XPB, Vol. 21, No. 5, May 1997. Statistics Canada, Federal Scientific Activities 1997-98e, Cat. No. 88-204-XPB, July 1997. Statistics Canada, "Total Spending on Research and Development in Canada 1986 to 1997, and Provinces 1986 to 1995," Science Statistics, Cat. No. 88-001-XPB, Vol. 21, No. 8. August 1997. Statistics Canada, "Estimation of Research and Development Expenditures in the Higher Education Sector, 1995-1996," Science Statistics, Cat. No. 88-001-XPB, Vol. 21, No. 9, August 1997. Statistics Canada, Estimation of Research and Development Expenditures in the Higher Education Sector, 1995–1996, Working Paper ST-97-06, Science and Technology Redesign Project, August 1997. Statistics Canada, Estimates of Canadian Research and Development Expenditures (GERD), Canada, 1986 to 1997, and by Province, 1986 to 1995. Working Paper ST-97-07. Science and Technology Redesign Project, August 1997.

References (cont'd)

 Statistics Canada, Industrial Research and Development, 1997 Intentions, Cat. No. 88-202-XPB, August 1997.
Statistics Canada, "Computers in the Workplace," Perspectives on Labour and Income,

Cat. No. 75-001-XPE, Vol. 9, No. 2, Summer 1997.

- Statistics Canada, The Importance of Research and Development for Innovation in Small and Large Canadian Manufacturing Firms, Research Paper Series, No. 107, Analytical Studies Branch, September 1997.
- The Scientist, *Citation Data Reveal World Rankings of Scientific Papers*, Vol. 11, No. 14, July 7, 1997.