DEPARTMENT OF SCIENCE AND TECHNOLOGY

National Survey of Research and Experimental Development (R&D)
(2001/2 Fiscal Year)

HIGH-LEVEL KEY RESULTS

15 January 2004

Department of Science and Technology

CONTENTS

*or latest year available

PREFACE

Relevant and reliable information is key to the planning and management of our national system of innovation. It is therefore with great pleasure that we now release the key high-level results of the latest National Research and Development Survey. The Survey is in respect of the fiscal year 2001/2.

This Survey was conducted according to the OECD guidelines that are embodied in the 'Frascati Manual' and are therefore internationally comparable with 30 countries.

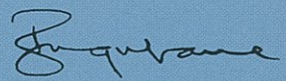
The key indicators that this Survey covers provide essential information on the vitality of our national system of innovation. The most widely used indicator of a country's commitment toward research and development is the percentage of GDP expended on this activity. At 0,76% of GDP it suggests that our public and private resourcing of research and development has remained robust and indeed grown in real terms since 1997/98 when the previous survey was conducted.

The National R&D Strategy has set the target that national spending on R&D should reach 1% of GDP by 2005 and we are therefore heartened to note that a positive movement has occurred. There are therefore grounds for optimism but also much remains to be done.

The high-level results suggest that there is much to do on the demographic transformation of the system and a need to ensure that industry-academic linkages generate innovation. This will be the subject of surveys based on the OECD 'Oslo Manual.'

We look forward to the outcome of the more detailed sector reports that will be presented in February and March.

Conducting a National R&D Survey is a highly complex task and I record my sincere appreciation to all those who worked on bringing this Survey to fruition. In particular we express our thanks to the Knowledge Management Group of the HSRC headed by Professor Michael Kahn who conducted the Survey in partnership with the Department.



Dr B S Ngubane
Minister of Arts, Culture, Science and Technology, MP
Cape Town, 15 January 2004

TABLE 1: KEY FIGURES

INDICATOR	VALUE
Gross domestic expenditure on R&D – GERD (millions Rands)	7 499.6
GERD – (million current purchase power parity $)	1 496.9
GERD as a percentage of GDP	0.76
Total R&D personnel (FTE)*	33 897 (a)**
Total researchers (FTE)	8 661 (b)***
Total researchers per 1000 labour force (FTE)	1.9
Total R&D personnel per 1000 labour force (FTE)	7.3
Estimated civil GERD as a percentage of GDP	0.71
Total researchers (headcount)	19 452
Women researchers as a percentage of total researchers	35.3

*FTE = full time equivalent
**(a) The figure for total R&D personnel includes the inputs of Masters and Doctoral research students
***(b) Excludes inputs of Masters and Doctoral research students

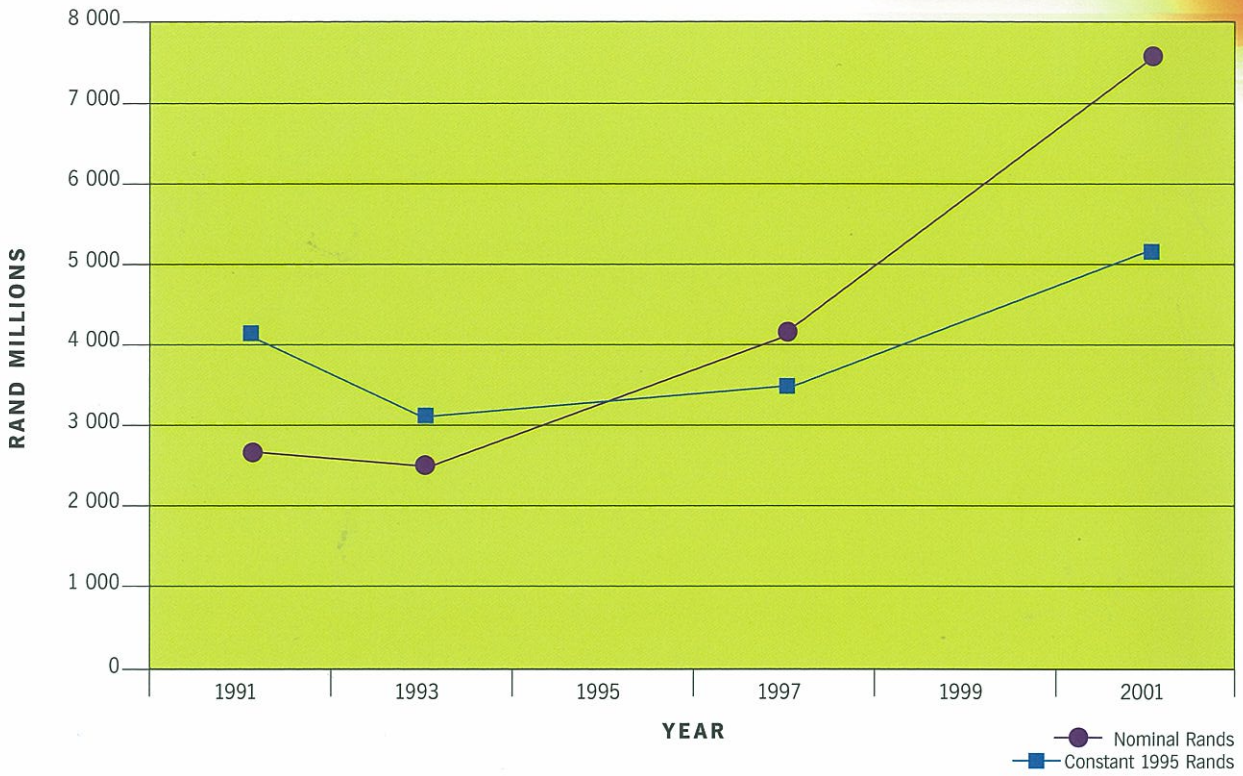
R&D expenditure showed a fairly sharp decrease between 1991 and 1993. Since 1993, R&D expenditure has grown both in nominal and real terms. In 2001/2 total R&D expenditure in South Africa reached a level of R7.5 billion, representing an average annual real growth of 2.5% since 1991. However, it should be noted that previous surveys have followed variant methodologies and fieldwork plans and therefore the changes should be seen in this context.

SOURCE: South African National R&D Surveys

NOTE: National R&D surveys were not undertaken in 1995 and 1999

Fig 1:

Gross expenditure on R&D (GERD)
(South Africa, 1991-2001)

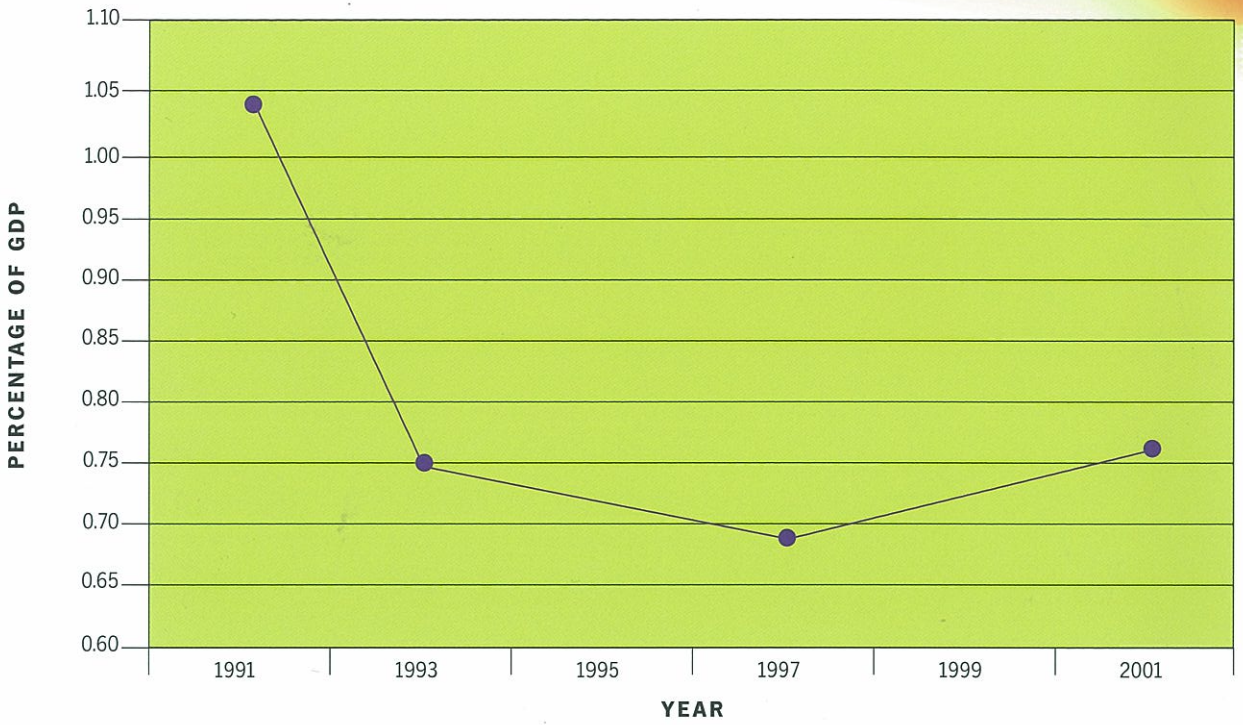


Gross national R&D expenditure (GERD) expressed as a percentage of GDP is an indication of the intensity of R&D in an economy. Despite increases in R&D expenditure in real terms since 1993 this has not kept pace with the growth of the economy since 1991 when R&D expenditure represented 1.04% of GDP. However, there has been an encouraging increase in R&D expenditure as a percentage of GDP from 0.69% in 1997 to 0.76% in 2001. This suggests there is some robustness in the current system of innovation, but the challenge to reach the goal of 1% of GDP remains.

SOURCE: South African National R&D Surveys

Fig 2:

Gross expenditure on R&D as a percentage of GDP
(South Africa, 1991-2001)



An important indicator of the economic competitiveness of countries is the intensity of R&D. Sweden is the world leader in R&D intensity, with R&D expenditure equivalent to 4.27% of GDP. South Africa has a higher R&D intensity than many developing countries but needs to keep pace with countries such as China where R&D expenditure has increased from a level of 0.60% of GDP in 1995 to 1.09% of GDP in 2001.

SOURCE: International comparisons – OECD Main Science and Technology Indicators, (2003 Edition) and individual country reports

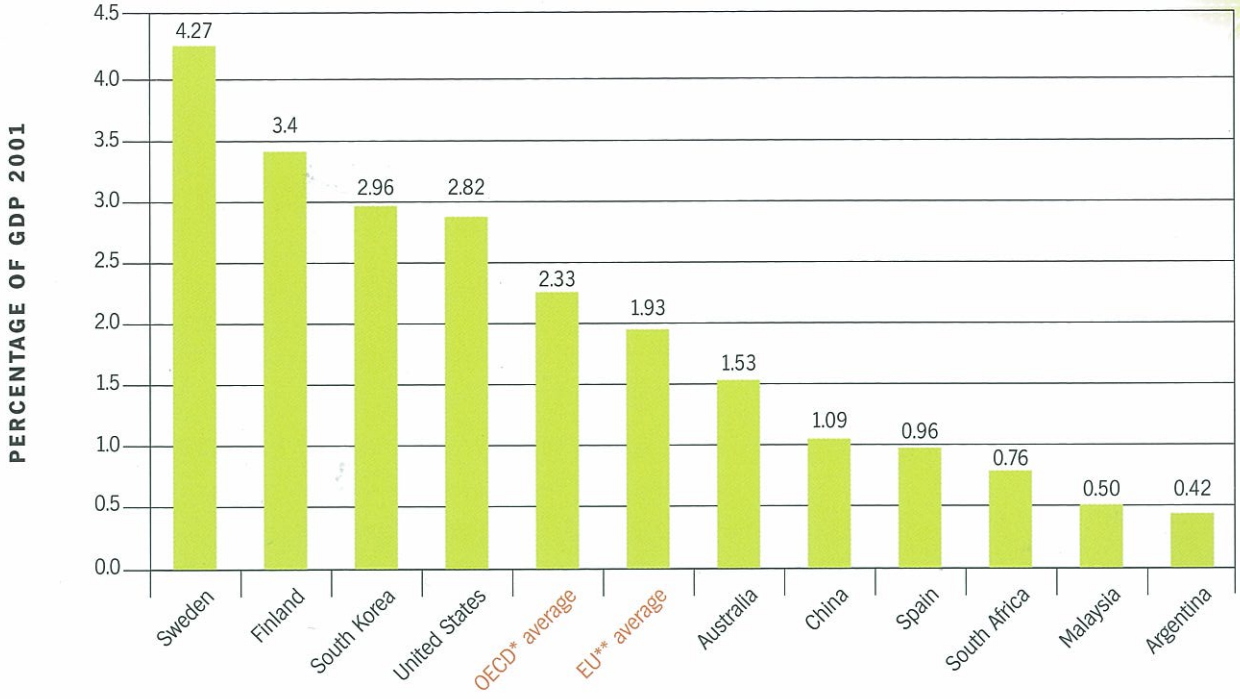
Fig 3:

Gross expenditure on R&D as a percentage of GDP 2001*

*or latest year available

* Organisation for Economic Cooperation and Development

** European Union

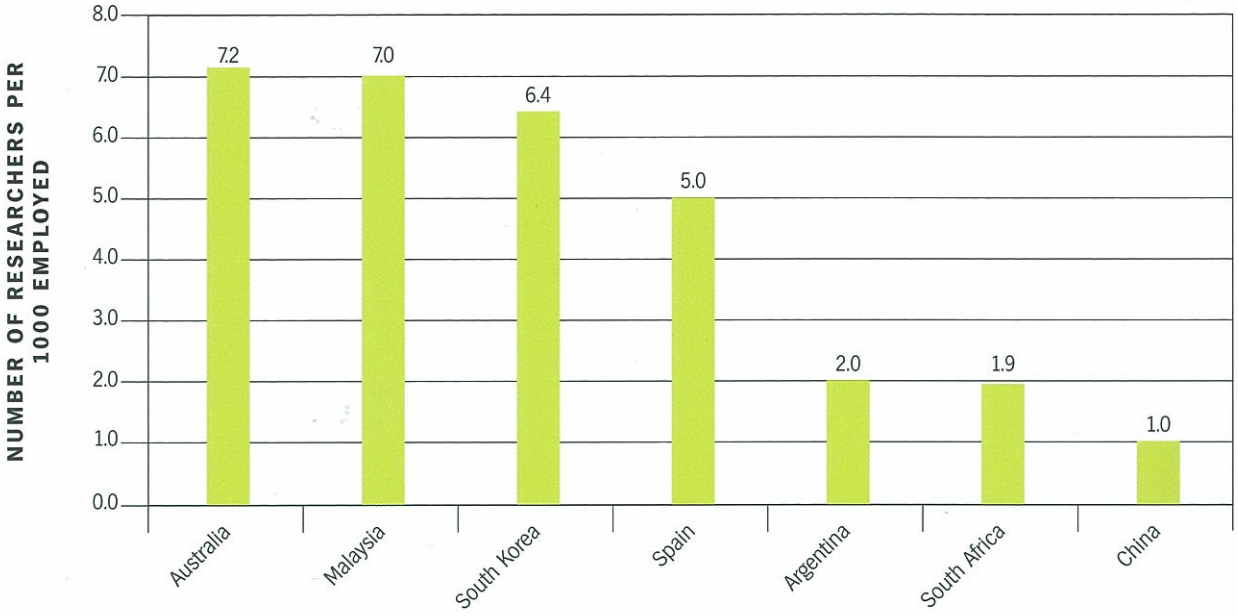


The number of full time equivalent (FTE) researchers per 1000 total employment is an important indicator of the availability of research skills in the labour force of a country. South Africa has a relatively low number of researchers of 1.9 per 1000 employed although this represents a substantial increase since the 1997 figure of 0.71 FTE researchers per 1000 labour force; survey methodologies could account for some of the difference.

Fig 4:

Number of Full Time Equivalent (FTE) researchers per 1000 total employed in 2001*

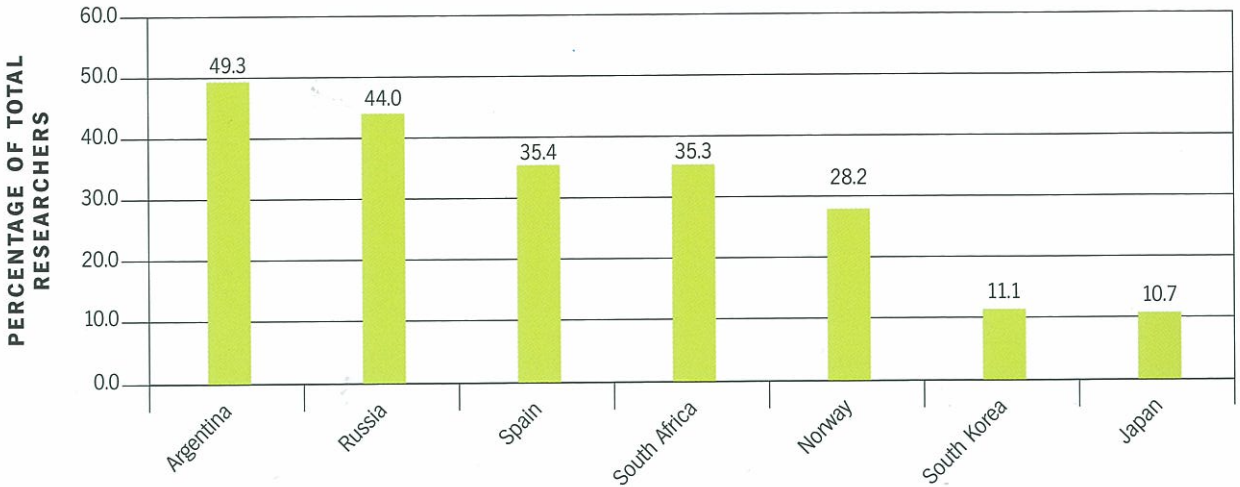
*or latest year available



Relatively few countries, even in OECD and EU member states, currently provide data on women in their R&D statistics. While South Africa's figure of 35.3% women researchers leaves much room for improvement the country appears to be performing better than several other countries in this critical domain.

Fig 5:

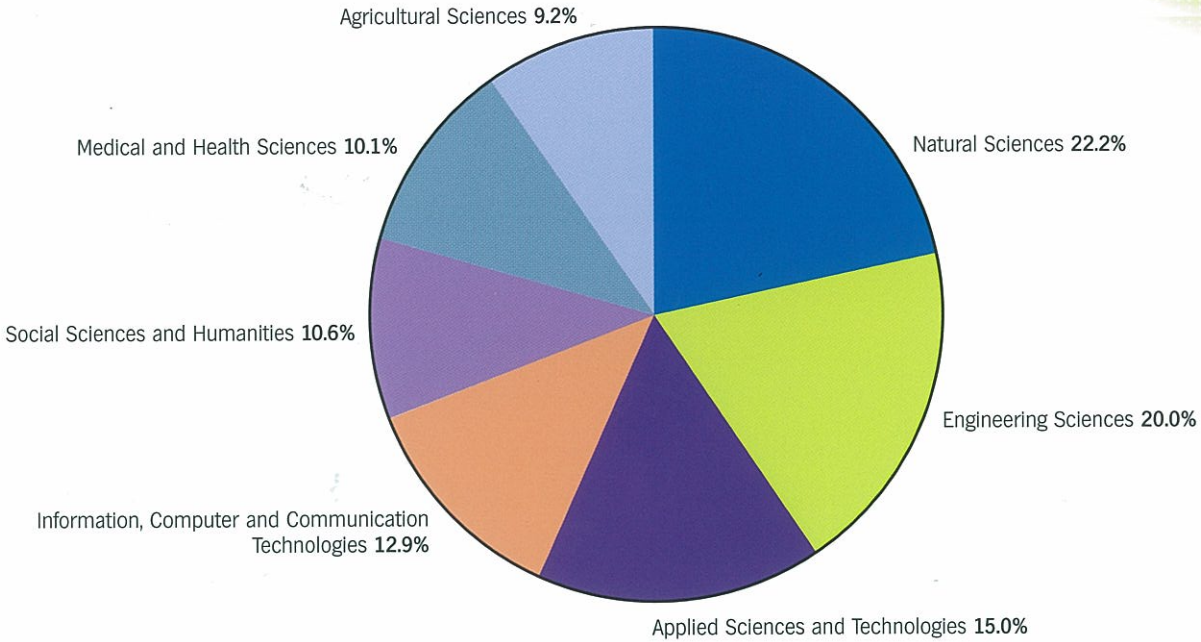
Women researchers as a percentage of total researchers (headcount) 2001



South Africa devotes the most R&D to fields in the natural sciences (22.2%), followed by engineering sciences (20.0%) and applied sciences and technology (15.0%). Information, computer and communication technologies account for a further 12.9% of expenditure. Varying classification systems used in different R&D surveys make comparisons difficult but medical and health sciences appear to have increased from 9% in 1997 to 10.6% in 2001 and social sciences and humanities have increased from 8% to 10.6% in the same period.

Fig 6:

Expenditure on R&D by major research field
(South Africa, 2001)

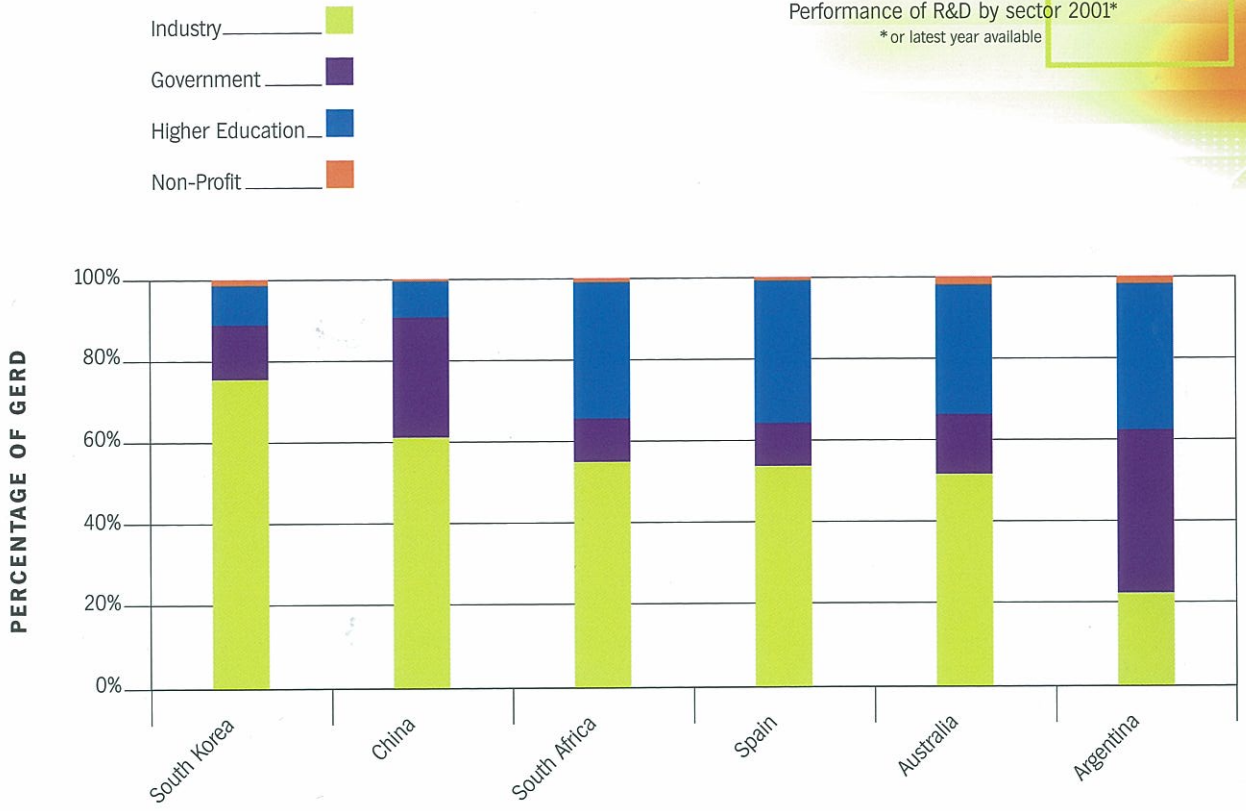


There are no ideal levels for the proportions of R&D performed by the different sectors of a country's economy but there needs to be a balance that is consistent with the national strategic objectives. In South Korea the industrial sector performs more than 76% of R&D while in China government and industry together perform more than 90% of R&D. In South Africa there is a fair balance between the sectors and industry performs nearly 54% of R&D while the higher education sector accounts for 25% of R&D. Government (including the eight science councils) accounts for 20% of R&D expenditure. There has been a significant shift from 1991 where industry performed 47% of R&D and government undertook 27% of R&D. Both in 1991 and 2001 higher education performed 25% of R&D.

Fig 7:

Performance of R&D by sector 2001*

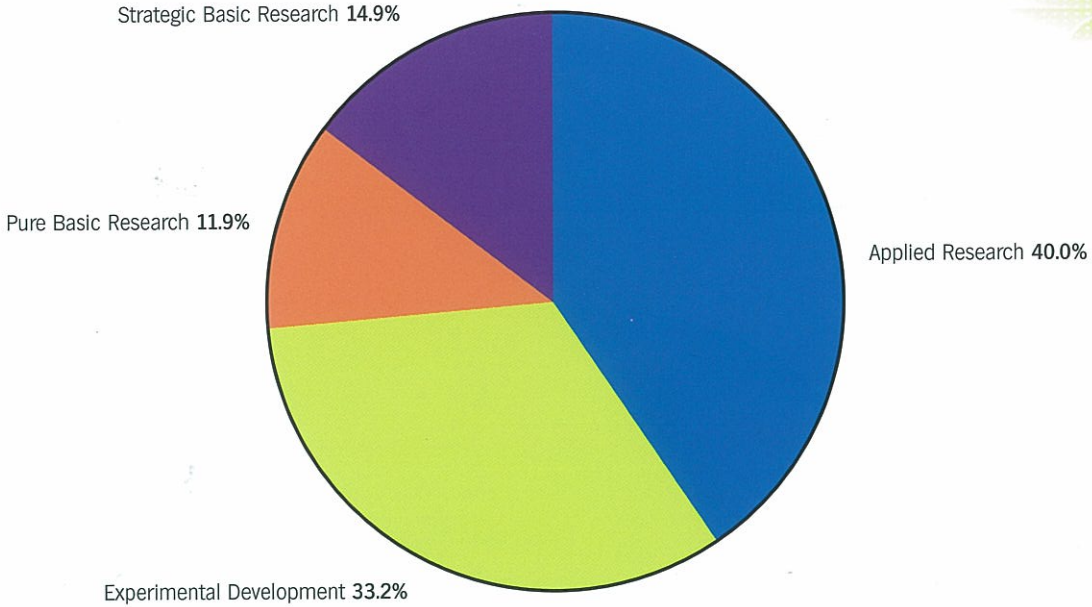
* or latest year available



Pure basic research and strategic basic research together accounted for 26.8% of R&D in 2001. Applied research and experimental development (near market research) accounted for 40.0% and 33.2% respectively. These figures do not include a further 8.4% of R&D, which was not classified into type of R&D by respondents. There appears to have been an increase in expenditure on basic research since previous surveys but this is balanced by expenditure on more applied and market orientated research.

Fig 8:

Gross expenditure on R&D by type
(South Africa, 2001)



Basic research expenditure (as a percentage of GDP) is an indicator that signals the R&D capacity that is responsive to new challenges and new knowledge. The United States spends 0.59% of GDP on basic research and given the size of the US economy represents a massive investment in R&D capacity development. South Africa's expenditure on basic research of 0.19% remains at the level of the 0.20% spent in 1991.

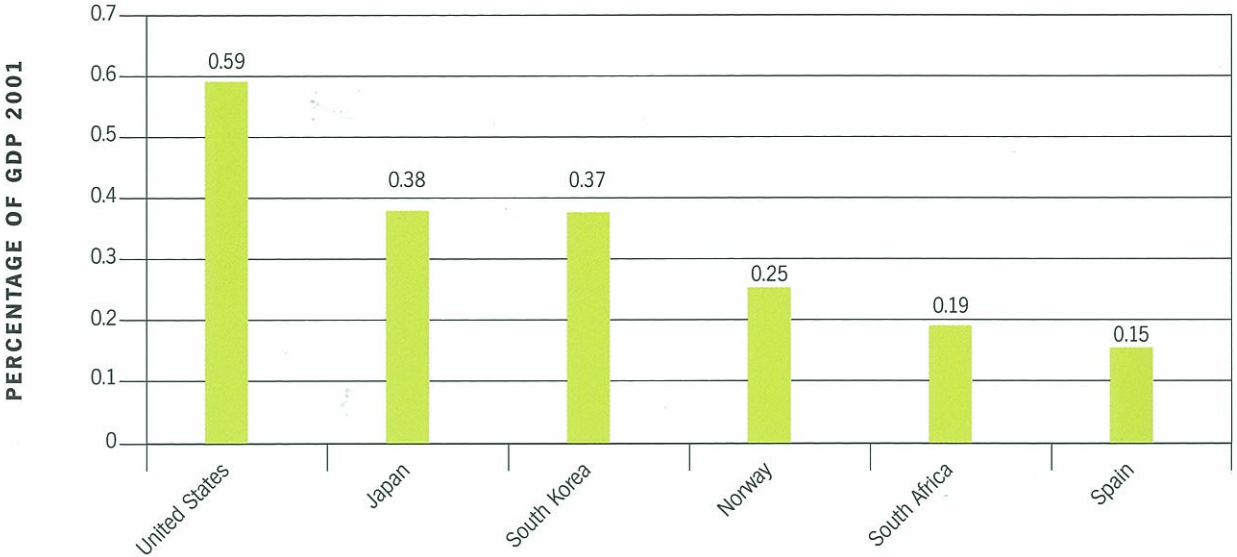
**Pure Basic Research: Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without a specific application in view.

Strategic Basic Research: Basic research directed into specific broad areas in expectation of useful discoveries.

Fig 9:

Basic** research as a percentage of GDP 2001*

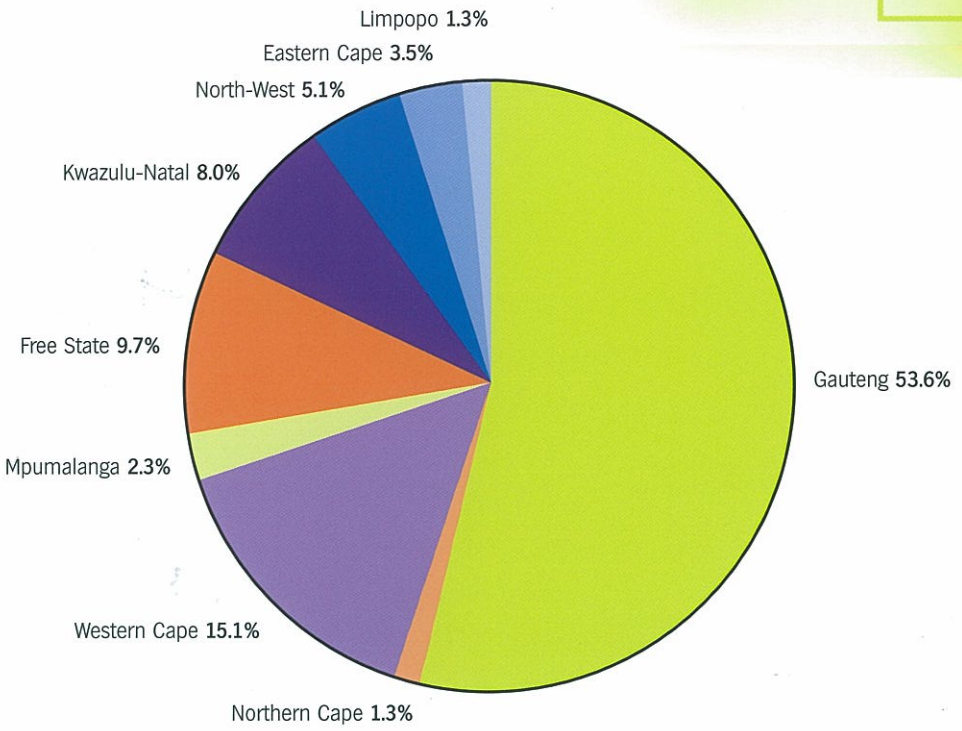
*or latest year available



Gauteng-based R&D activities account for 53.6% of all R&D expenditure in South Africa, followed by the Western Cape (15.1%), Free State (9.7%) and KwaZulu-Natal (8.0%). Although in percentage terms R&D in some provinces such as Limpopo and the Northern Cape appears to be comparatively minor, the 1.3% of expenditure recorded in these provinces represents about R100 million of R&D.

Fig 10:

Provincial R&D expenditure
(South Africa, 2001)



At first glance the demographics of the R&D workforce are not impressive with only 36.5% of the ranks drawn from previously disadvantaged groups (African, Indian and Coloured). However, these demographic changes have progressed from a very low base since 1994. For example in 1994, in a survey[1] of the eight science councils, skilled technicians, technologists and graduates (roughly equivalent to the R&D workforce) from these disadvantaged groups represented only 7.3% of the total. In the 2001/02 R&D survey of the science councils R&D staff from disadvantaged groups had increased to represent 45.6% of the total. While there is still a long way to go it is clear that sound progress has been made towards the goal of achieving greater equity in the R&D workforce.

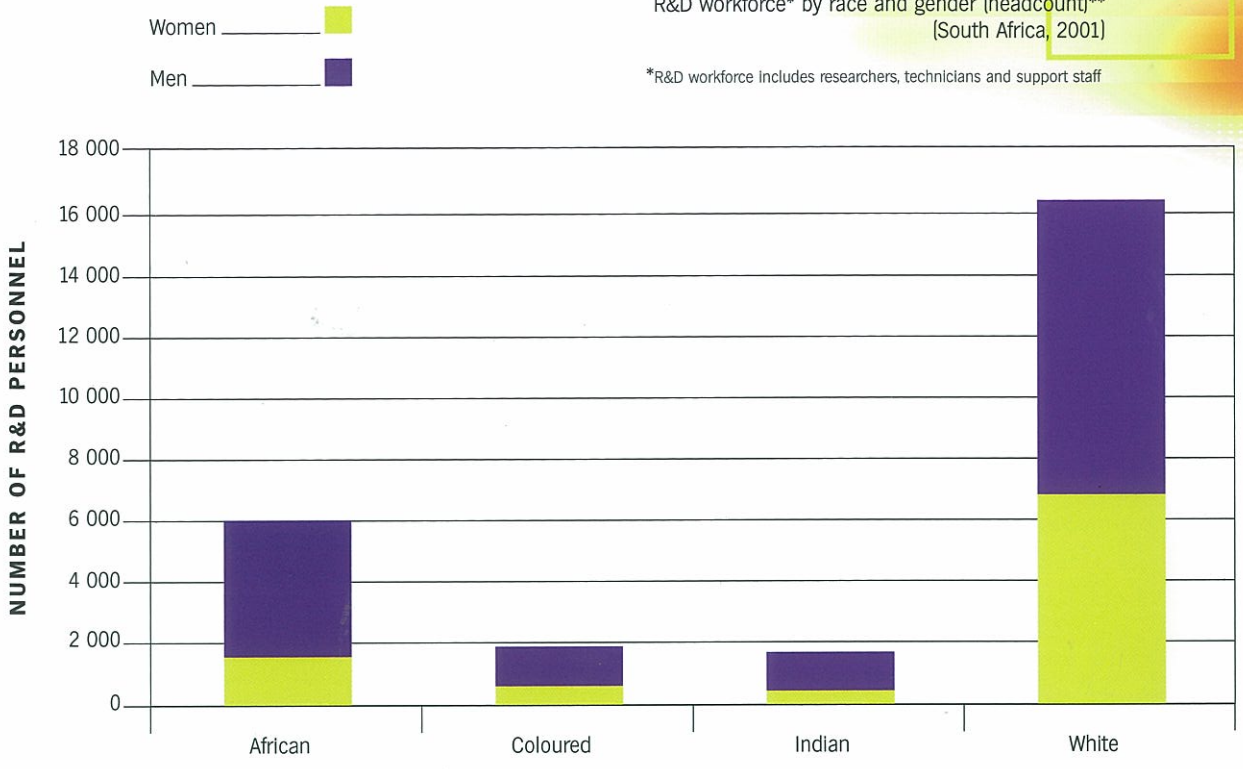
[1] Motala, Enver (1994). *The employment composition and affirmative action programmes of the science councils in South Africa* (A study conducted for the Science and Technology Initiative, April 1994).

**NOTE: Excludes postgraduate research students

Fig 11:

R&D workforce* by race and gender (headcount)**
(South Africa, 2001)

*R&D workforce includes researchers, technicians and support staff



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