

HSRC RESEARCH OUTPUTS

3829

# **Agricultural Research Expenditure**

## **Data Extraction for the Department of Science and Technology**

Centre for Science, Technology and Innovation Indicators  
(CeSTII)

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## **Introduction**

This report will address the following questions as posed by the Department of Science and Technology in relation to Agricultural Research and Development in South Africa.

### **National**

Question 1: What is the agricultural contribution to GDP (AgriGDP)?

Question 2: What is the total investment in agriculture as a percentage of AgriGDP?

Question 3: What are the current sources of funding for Agricultural R&D (AgriR&D) in SA?

Question 4: How is the investment in AgriR&D split between provinces?

Question 5: What is the expenditure per type of AgriR&D activities nationally (Pure Basic, Strategic Basic, Applied, Exp Development)?

Question 6: What is the total head count of researchers and technicians etc involved in AgriR&D?

Question 7: What is the proportion of AgriR&D expenditure by Research Field?

### **Per-Sector or Per-Institution**

Question 8: What is the AgriR&D Expenditure as a percentage of the government spend on R&D?

Question 9: What is the AgriR&D Expenditure by Higher education institutions?

Question 10: What is the AgriR&D Expenditure by Science Councils?

Question 11: What is the number of FTE researchers in AgriR&D? (In ARC, Universities, HEIs, and Provincial departments)

## **Selection Methodology**

The data set acquired from the 2003/04 National R&D Survey was used to do this extraction and compilation.

The data required for the extraction related only to organizations that participated in agricultural research activities. It was therefore only possible to identify organizations that entered either RF (Research Field) codes or SEO (Socio-Economic Objective) codes, which fall into the desired category. The RF and SEO Codes used are the broad agriculture codes that include forestry and fishing as well as agriculture.

The relevant codes are as follows

RF Codes: RF10900 – RF10999 (Inclusive)

SEO Codes: S20100 – S20299 (Inclusive)

Only data that fall into the selected categories or the relevant proportional extractions of other data were included in the final tables. The data was aggregated and inclusive; it was therefore not necessary to first establish which organisations partook in Agricultural Research and Development.

The full high level Survey Report, Questionnaires and Codes can be found at [www.hsra.ac.za/RnDSurvey](http://www.hsra.ac.za/RnDSurvey)

## Tracking Agricultural R&D

R&D activity in the broad field of Agriculture is carried out across the national system of innovation, in the government sector (including science councils) by universities and in the private sector. Tracking this expenditure is complex, since there is no central register of R&D performers, except for the case of R&D that involves genetic modification.

Identifying Agriculture R&D performers thus arises through the participation of such performers in the National R&D Survey that CeSTII performs on behalf of the Department of Science and Technology.

Even so the way that different performers complete the questionnaire especially in the way they aggregate their totals across divisions may contrive to mask performance of Agriculture R&D (or any other area for that matter). This survey artefact is not so much a problem of survey design as a problem of questionnaire completion. The application of much higher resource levels to conducting the survey from bottom up might improve the detailed data, but the underlying issue of survey fatigue if not resistance will remain.

It is for these reasons that it was necessary to identify performers backwards from the database of Research Field (RFs) and Socio-economic Objectives (SEOs). Extractions were thus effected per RF code and SEO Code in order to provide as comprehensive a description of the situation as possible. This allows one to estimate the headcount and FTE of staff engaged in Agriculture R&D according to the expenditure identified by RF or SEO Codes. It is felt to be useful to provide estimates by both of these identifiers given the discretion that survey completers exercise in attributing activity by RF and SEOs. It may be argued that the estimates based on SEO are a better representation than the information generated from the RFs since SEOs reflect *intent*.

### Example

An organisation undertook research represented by 3 RF codes

- 25% in 10801
- 50% in 10902
- 25% in 10702.

If the organisation reported R&D capital expenditure of R100, 000 this would be distributed *pro rata* across the three RF codes as follows:

- R25, 000 on 10801
- R50, 000 on 10902
- R25, 000 on 10702

And similarly if the organisation recorded a researcher headcount of 9 then those researchers might be distributed as follows:

- 2.25 Researchers on 10801
- 4.5 Researchers on 10902
- 2.25 Researchers on 10702

These would then be summed to give totals per RF for the entire national system of innovation.

The same technique would be used to distribute values according to SEO Codes

## Tables and Results

The summary table below gives a comparison of all Agricultural R&D done in South Africa by sector.

The table compares the extractions done using the RF Codes and the SEO codes and then presents this data in separate tables.

Although the totals are very close the breakdown per sector does vary substantially with Business and Government investing more according to the RF Codes than they invest according to the SEO Codes, Higher Education and Science Councils investing more according to the SEO Codes than according to the RF Codes and Non-Profit Organisations remaining very much unchanged.

This can be explained to a certain degree as follows: An institution such as a university may be developing a new food crop harvesting device in their engineering faculty and would include the amount spent on this development in the Engineering related RF Codes. The end use for the product would be for farming, hence the product SEO Code would fall into farming. This amount would thus not show up in the Agricultural RF Codes but would appear in the Agricultural SEO Codes.

**Table 1: Summary Table: Agri  
Exp Across all sectors**

Business enterprise	200,855,770	27.1	175,168,940	23.7
Government	141,459,890	19.1	92,660,870	12.5
Higher education	97,995,557	13.2	127,734,848	17.3
Not-for-profit	13,646,000	1.8	14,388,500	1.9
Science Councils	287,631,640	38.8	330,447,530	44.6
<b>Total</b>	<b>741,588,857</b>	<b>100.0</b>	<b>740,410,688</b>	<b>100.0</b>

## National

Questions 1 and 2: What is the agricultural contribution to GDP (AgriGDP)?  
What is the total investment in agriculture as a percentage of AgriGDP?

**Table 2: Proportion of GDP (2003)**

2003 Revised GDP (Billions)*	1257025	
Agriculture, Forestry and Fishing (Billions)*	40889	3.25
Agriculture, Forestry and Fishing R&D as a % of Agri GDP (Millions)	741589	1.81

\*Source: Stats SA website

The proportion of AgriR&D to AgriGDP is 1.81%. This is significantly higher than the proportion of Total R&D to Total GDP, which is 0.81% as reported in the 2003/04 R&D Survey Report.

Question 3: What are the current sources of funding for Agricultural R&D in SA?

**Table 3: Sources of Funding Using Research Field as Identifier**

Government	Higher Education Vote allocated to research	10,998,358	2.7
Government	National & Provincial Government	187,982,158	25.3
Government	Science Councils & Agency Funding	31,355,622	4.2
Local Business	Locally based (domestic) business	94,657,311	12.8
Other International Sources	All Sources	13,099,370	1.8
Other International Sources	Other International Sources	10,121,616	1.4
Other South African Sources	Other South African Sources	48,311,557	6.5
Own Funds	Internal Resources (including equity, borrowing and retained earnings)	335,466,809	45.2
Universities/Technikons/Colleges	University/Technikon/College	596,055	0.1
<b>Total</b>		<b>741,588,857</b>	<b>100.0</b>

**Table 4: Sources of Funding Using SEO as Identifier**

Government	Higher Education Vote allocated to research	11,830,868	1.6
Government	National & Provincial Government	155,786,320	21.0
Government	Science Councils & Agency Funding	30,318,053	4.1
Local Business	Locally based (domestic) business	129,552,546	17.5
Other International Sources	All Sources	11,853,420	1.6
Other International Sources	Other International Sources	23,663,307	3.2
Other South African Sources	Other South African Sources	70,542,248	9.5
Own Funds	Internal Resources (including equity, borrowing and retained earnings)	306,368,751	41.4
Universities/Technikons/Colleges	University/Technikon/College	495,175	0.1
<b>Total</b>		<b>740,410,688</b>	<b>100.0</b>

Both RF and SEO codes 'Own Funds' are the greatest source of funds for AgriR&D. 'Local Business' increased from providing 12.8% of funding for AgriR&D by RF Code to 17.5% of funding by SEO Code.

Although there are obviously some variations in the absolute quanta per line item, the pattern of funding revealed by RF and SEO is the same.

**Question 4: How is the investment in AgriR&D split between provinces?**

The data for tables 6 and 7 below were extracted from the 2001/02 survey as the above question was not asked in this form in the 2003/04 survey.

**Table 5: Expenditure By Province (2001/02) using Research Field as Identifier**

Eastern Cape	31,384,164	5.3
Free State	38,163,344	6.4
Gauteng	130,952,531	22.1
KwaZulu-Natal	113,912,850	19.2
Limpopo	13,628,352	2.3
Mpumalanga	61,061,891	10.3
Northern Cape	27,946,706	4.7
North-West	29,289,398	4.9
Western Cape	85,353,499	14.4
Unallocated	62,012,964	10.4
<b>Total</b>	<b>593,705,700</b>	<b>100</b>

**Table 6: Expenditure By Province (2001/02) using SEO as Identifier**

Eastern Cape	27,840,448	5.2
Free State	31,945,191	6.0
Gauteng	135,369,289	25.4
KwaZulu-Natal	134,338,926	25.2
Limpopo	11,353,359	2.1
Mpumalanga	59,381,775	11.2
Northern Cape	24,085,107	4.5
North-West	28,975,899	5.4
Western Cape	67,612,064	12.7
Unallocated	11,185,488	2.1
<b>Total</b>	<b>532,087,547</b>	<b>100</b>

As would be expected Gauteng and Kwazulu-Natal dominate the Agri R&D expenditure with the Western Cape and Mpumalanga third and fourth respectively, a finding that is shown both by RF and SEO.



**Question 5:** What is the expenditure per type of AgriR&D activities nationally (Pure Basic, Strategic Basic, Applied, Exp Development)?

**Table 7: Expenditure By Activity Using Research Field as Identifier**

Pure Basic Research	40,574,172	5.5
Strategic Basic Research	106,118,980	14.3
Applied Research	397,333,677	53.6
Experimental Research	197,562,027	26.6
<b>Total</b>	<b>741,588,857</b>	<b>100.0</b>

**Table 8: Expenditure By Activity Using SEO as Identifier**

Pure Basic Research	57,859,696	7.8
Strategic Basic Research	93,022,792	12.6
Applied Research	375,705,193	50.7
Experimental Research	213,823,007	28.9
<b>Total</b>	<b>740,410,688</b>	<b>100.0</b>

‘Applied Research’ dominates the AgriR&D expenditure with ‘Pure Basic Research’ receiving by far the least attention.

**Question 6:** What is the total head count of researchers and technicians etc involved in AgriR&D?

**Table 9: Total Headcount using Research Field as identifier**

Researchers	1278
Technicians Directly Supporting R&D	667
Other Personnel Directly Supporting R&D	1873
<b>Total</b>	<b>3818</b>

**Table 10: Total Headcount using SEO as identifier**

Researchers	1238
Technicians Directly Supporting R&D	650
Other Personnel Directly Supporting R&D	1969
<b>Total</b>	<b>3857</b>

**Question 7: What is the proportion of AgriR&D expenditure by Research Field?**

**Table 11: Breakdown by RF**

Agricultural sciences	13,948,296	1.9
Soil and water sciences	70,271,420	9.5
Crop and pasture production (including rice)	125,341,958	16.9
Horticulture (including plantation and fruit crops)	153,708,526	20.7
Animal production	78,764,550	10.6
Veterinary sciences	55,857,993	7.5
Forestry sciences	42,423,835	5.7
Fisheries sciences	33,302,016	4.5
Food and nutrition development	76,133,448	10.3
Aquaculture	40,021,116	5.4
Plant physiology	10,003,215	1.3
Other agricultural sciences not elsewhere classified	41,812,483	5.6
	<b>741,588,857</b>	<b>100.0</b>

'Horticulture', 'Crop and Pasture Production' and 'Animal Production' account for almost half the AgriR&D Expenditure by RF. While 'Field Crops', 'Livestock' and 'Horticulture' account for over 60% of the AgricR&D Expenditure by SEO.

**Table 12: Breakdown by SEO**

Plant production and plant primary products	51,416,080	6.9
Field crops	173,663,595	23.5
Plantation crops	61,109,667	8.3
Horticultural crops	121,220,658	16.4
Forestry	41,261,005	5.6
Primary products from plants	13,476,385	1.8
By-product utilisation	34,600	0.0
Other plant production and plant primary products not elsewhere classified.	6,163,225	0.8
Animal production and animal primary products	19,040,000	2.6
Livestock	165,764,958	22.4
Pasture, browse and fodder crops	43,442,201	5.9
Fisheries products	14,567,555	2.0
Primary & by-products from animals	11,792,259	1.6
Other animal production and animal primary products not elsewhere classified	17,458,500	2.4
<b>Total</b>	<b>740,410,688</b>	<b>100.0</b>

## Per-Sector or Per-Institution

**Question 8:** What is the AgriR&D Expenditure as a percentage of government spend?

**Table 13: R&D Expenditure as a proportion of Government R&D expenditure using Research Field as Identifier**

Mathematical Sciences	5,781,850	1.2
Physical Sciences	0	0.0
Chemical Sciences	493,300	0.1
Earth Sciences	38,377,500	8.2
Information, Computer and Communication	3,493,670	0.8
Applied Sciences and Technologies	16,757,500	3.6
Engineering Sciences	115,800	0.0
Biological Sciences	64,810,880	13.9
	15,993,000	3.4
Medical and Health Sciences	66,893,000	14.4
Environmental Sciences	13,037,230	2.8
Material Sciences	0	0.0
Marine Sciences	21,352,190	4.6
Social Sciences	81,865,910	17.6
Humanities	11,128,300	2.4
<b>Total</b>	<b>485,367,000</b>	<b>100</b>

AgriR&D accounts for 30.4% of total government expenditure on R&D when extrapolated using RF Codes.

**Table 14: R&D Expenditure as a proportion of Government R&D expenditure using SEO as identifier**

	4,754,750	0.9
	1,501,200	0.3
Energy Supply	4,754,750	1.0
Construction	1,501,200	0.3
Information and Communication Services	5,194,820	1.1
Commercial Services	1,942,130	0.4
Economic Framework	54,989,700	11.8
Natural Resources	113,330,880	24.4
Health	66,844,100	14.4
Education and Training	11,853,190	2.5
Social Development and Community Services	17,732,390	3.8
Environmental Knowledge	49,294,820	10.6
Environmental Aspects of Development	4,679,400	1.0
Environmental and Other Aspects	8,724,190	1.9
Natural Sciences, Technologies and Engineering	16,619,320	3.6
Social Sciences and Humanities	15,245,260	3.3
<b>Total</b>	<b>485,367,000</b>	<b>100.0</b>

Total AgriR&D Expenditure accounts for 19.9% of government expenditure when the SEO Codes are used to extrapolate the expenditure. This includes the two SEO categories known as 'Plant Production and Plant Primary Products' and 'Animal Production and Animal Primary Products'.

**Question 9: What is the AgriR&D Expenditure by Higher education institutions?**

As mentioned previously some major Higher Education Institutions may appear to be non-performers of AgriR&D if the relevant RF falls into a non-Agriculture related area compared with SEOs or vice versa.

**Table 15: Higher Education Agriculture R&D expenditure using Research Field as Identifier**

Border Technikon	0	0.0
Cape Technikon	204,700	0.2
Damelin International College of Post Graduate Business	0	0.0
Durban Institute of Technology (DIT) (Former Natal and M.L. Sultan Techs)	1,458,510	1.5
Eastern Cape Technikon	0	0.0
Gordon Institute of Business Science (Part of Univ of Pretoria)	0	0.0
Mangosuthu Technikon	362,000	0.4
Medical University of South Africa (MEDUNSA)	81,980	0.1
Monash University	0	0.0
North West University - Mbabatho Campus	105,150	0.1
North West University - Potch Campus	1,434,700	1.5
Peninsula Technikon	0	0.0
Port Elizabeth Technikon (Not started)	1,117,900	1.1
Rand Afrikaans University (Not started)	1,436,228	1.5
Rhodes University	4,167,869	4.3
Technikon Free State	566,063	0.6
Technikon Witwatersrand	945,150	1.0
Tshwane University of Technology (TUT) (Former Tech North West, North Gauteng, Pretoria)	16,697,500	17.0
University of Cape Town	9,349,830	9.5
University of Fort Hare	1,163,064	1.2
University of KwaZulu Natal (Former NU and UDW)	7,378,000	7.5
University of Port Elizabeth	0	0.0
University of Pretoria	26,336,062	26.9
University of South Africa (Including TSA and Vista) "Not Started"	0	0.0
University of Stellenbosch	14,047,359	14.3
University of the Free State (Incl. UN Qwa Qwa Campus)	5,528,460	5.6
University of the North	766,905	0.8
University of the Western Cape (not started)	2,432,886	2.5
University of the Witwatersrand	0	0.0
University of Venda for Science and Technology	1,356,321	1.4
University of Zululand	290,030	0.3
Vaal University of Technology (Was VTT)	768,890	0.8
<b>Total</b>	<b>97,995,557</b>	<b>100.0</b>

**Table 16: Higher Education Agriculture R&D expenditure using SEO as identifier**

Border Technikon	0	0.0
Cape Technikon	0	0.0
Damelin International College of Post Graduate Business	0	0.0
Durban Institute of Technology (DIT) (Former Natal and M.L. Sultan Techs)	1,721,520	1.3
Eastern Cape Technikon	0	0.0
Gordon Institute of Business Science (Part of Univ of Pretoria)	0	0.0
Mangosuthu Technikon	543,000	0.4
Medical University of South Africa (MEDUNSA)	0	0.0
Monash University	0	0.0
North West University - Mbabatho Campus	0	0.0
North West University - Potch Campus	28,680	0.0
Peninsula Technikon	703,800	0.6
Port Elizabeth Technikon (Not started)	958,125	0.8
Rand Afrikaans University (Not started)	2,365,552	1.9
Rhodes University	2,762,200	2.2
Technikon Free State	0	0.0
Technikon Witwatersrand	0	0.0
Tshwane University of Technology (TUT) (Former Tech North West, North Gauteng, Pretoria)	6,679,000	5.2
University of Cape Town	0	0.0
University of Fort Hare	0	0.0
University of KwaZulu Natal (Former NU and UDW)	42,840,000	33.5
University of Port Elizabeth	0	0.0
University of Pretoria	16,935,922	13.3
University of South Africa (Including TSA and Vista) "Not Started"	1,027,125	0.8
University of Stellenbosch	17,671,824	13.8
University of the Free State (Incl. UN Qwa Qwa Campus)	7,108,020	5.6
University of the North	0	0.0
University of the Western Cape (not started)	0	0.0
University of the Witwatersrand	26,390,080	20.7
University of Venda for Science and Technology	0	0.0
University of Zululand	0	0.0
Vaal University of Technology (Was VTT)	0	0.0
<b>Total</b>	<b>127,734,848</b>	<b>100.0</b>

**Question 10: What is the AgriR&D Expenditure by Science Councils?**

**Table 17: Science Councils Agriculture R&D expenditure using Research Field as Identifier**

Agricultural Research Council	254,526,190	88.5
CSIR	29,355,030	10.2
Medical Research Council	3,750,420	1.3
<b>Total</b>	<b>287,631,640</b>	<b>100.0</b>

**Table 18: Science Councils Agriculture R&D expenditure using SEO as identifier**

Agricultural Research Council	320,662,520	97.0
CSIR	9,785,010	3.0
<b>Total</b>	<b>330,447,530</b>	<b>100.0</b>

Question 11: What is the number of FTE researchers in AgriR&D? (In ARC, Universities, HEIs, and Provincial departments)

*FTEs For the Agricultural Research Council (ARC)*

**Table 19: Agricultural Research Council FTEs using Research Field as Identifier**

Researchers	227
Technicians Directly Supporting R&D	208
Other Personnel Directly Supporting R&D	804
<b>Total</b>	<b>1239</b>

**Table 20: Agricultural Research Council FTEs using SEO as Identifier**

Researchers	251
Technicians Directly Supporting R&D	275
Other Personnel Directly Supporting R&D	1046
<b>Total</b>	<b>1573</b>

*FTEs For all Universities and Higher Education Institutions*

**Table 21: Higher Education FTEs using Research Field as Identifier**

Researchers	169
Technicians Directly Supporting R&D	30
Other Personnel Directly Supporting R&D	25
<b>Total</b>	<b>224</b>

**Table 22: Higher Education FTEs using SEO as Identifier**

Researchers	207
Technicians Directly Supporting R&D	21
Other Personnel Directly Supporting R&D	30
<b>Total</b>	<b>258</b>

**Table 23: Higher Education Post-Graduate Students FTEs using Research Field as Identifier**

Post-doctoral fellows	17
Doctoral Degree or Equivalent	112
Masters Degree or Equivalent	241
<b>Total</b>	<b>370</b>

**Table 24: Higher Education Post-Graduate Students FTEs using SEO as Identifier**

Post-doctoral fellows	12
Doctoral Degree or Equivalent	150
Masters Degree or Equivalent	260
<b>Total</b>	<b>422</b>

### *FTEs for Provincial Departments*

This includes the following departments:

Western Cape Agriculture  
North West Agriculture, Conservation and Environment  
Kwazulu-Natal Agriculture & Environmental Affairs: Allerton Veterinary Lab  
Kwazulu-Natal Agriculture & Environmental Affairs  
Free State Agriculture

All Provincial departments are not included as not all conducted AgriR&D and not all departments replied to the survey.

**Table 25: Provincial departments FTEs using Research Field as identifier**

Researchers	40
Technicians Directly Supporting R&D	66
Other Personnel Directly Supporting R&D	231
<b>Total</b>	<b>337</b>

**Table 26: Provincial departments FTEs using SEO as identifier**

Researchers	33
Technicians Directly Supporting R&D	53
Other Personnel Directly Supporting R&D	185
<b>Total</b>	<b>271</b>

### **Concluding remarks**

The above data compiled by means of the RF and SEO identifiers demonstrate a satisfactory level of robustness.

In particular Tables 11 and 12 show aggregate R&D expenditure captured by the two methods as agreeing to within 0,1%.

In general the two methods provide data totals that lie within 10% of one another, though in some cases this expands to close to 20%. Nonetheless the distribution of data by RF and SEO is identical.

We suggest that it is reasonable to regard whichever headcount and/or FTE is higher as a closer representation of the reality of staff allocation.

The sector for which the data is most problematic is that of higher education, for which sector a dedicated survey might be called for in future.

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