

**National Research and Experimental Development Survey 2004/05 : draft**  
Centre for Science, Technology and Innovation Indicators (CeSTII)  
Human Sciences Research Council

**Report to the Department of Science and Technology (DST)**  
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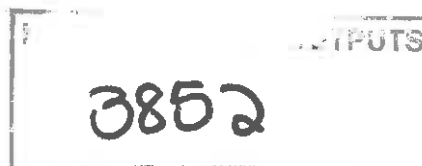
## **1) Introduction**

The launch of the 2004/05 Research and Experimental Development Survey in September 2005 was approached with an added sense of excitement amongst CeSTII staff due to the recognition received by Statistics South Africa to include the R&D survey as part of official South African statistics. This, accompanied by the fact that the 2001/02 survey results had been accepted by the OECD for inclusion in the Main Science and Technology Indicators (MSTI) and the OECD Science, Technology and Industry Scoreboard, added to the recognition of the Survey both nationally and internationally. The key results of the first two surveys were both presented at a press release in parliament by the Minister of Science and Technology and the 2004/05 Key High Level Results are due to be released by the Minister of Science on 25 May 2006.

It was decided that the 2004/05 R&D Survey would take the form of a "semi-light" questionnaire by incorporating the collection of race, gender, occupational and educational qualification headcount data into the questionnaire. Considerable time was spent refining key definitions and concepts included in the questionnaire. It was decided to reduce the number of explanatory notes and definitions incorporated within the business, not for profit, government and science council questionnaires. The Higher Education Sector questionnaire, on the other hand, made use of extended explanatory notes and definitions as agreed upon with the sector representatives at regional workshops. The revised questionnaire and User Guide were piloted across all sectors during the month of June, and eventually released to respondents during September 2005.

Although hard-copy questionnaires still proved to be the primary method of data collection, an electronic questionnaire that incorporated the additional feature of being able to calculate totals was introduced to survey respondents. This method of data collection proved especially popular amongst the Higher Education respondents. Data collection proved slower than usual in the business sector and the Science Council Sector (due to reasons discussed in the individual sector sections below). The Higher Education and government sectors, on the other hand, reported a quicker response from respondents.

The Meraka Institute at the CSIR remains responsible for the maintenance of the Survey Measurement and Result System (SMRS) and questionnaire capture and verification by CeSTII staff has generally continued unhindered. The use of two in-house consultants to run analyses and queries on the data



and effect imputations and commutations has proved invaluable in the execution of the survey.

National awareness of the survey seems to have improved as indicated by the increasing number of requests for data from external organisations. Requests for data have been received from the Medical Research Council, The Department of Science and Technology, the Meraka Institute, CSIR, the Department of Botany, University of Cape Town, Business Week, National Treasury, the National Department of Agriculture and Research Offices of the University of the North West, Stellenbosch, Pretoria and Durban Institute of Technology among others. A registry of requests has been created to record requests for survey information.

Data records show that Gross R&D expenditure for the 2004/05 survey should be up from that of last year, bringing South Africa steadily closer to the 1 percent of GDP mark.

## **2) Sector Summaries**

### **2.1) The Business Sector**

The business sector register has grown considerably over the last year and now contains over 2600 companies. Of these, over 2000 were found to be active in the economy. Based on expert knowledge and historical data, 522 were omitted from the survey based on indications that they did not perform any Research and Development. A further 244 entities were identified as being part of Company Group Structures and were therefore not measured separately. A total of 783 Units of Measure were thus identified for survey purposes.

Of the 627 Questionnaires that were dispatched by CeSTII, 208 (33 percent) were completed by respondents and returned to CeSTII. A further 88 (14%) responses were obtained telephonically. In addition, 120 UOM's that participated in the 2003/04 survey did not respond to the survey and their data was commuted to the current survey year. Of these, 76 confirmed telephonically that their data be commuted to the current survey year. To this were added 71 SPII Imputation Questionnaires, 49 regular imputes and 7 supplementary questionnaires.

Thus, a total of 546 questionnaires were completed and added to the database. This figure is up from the 424 received in 2003/04. In addition, 508 non-nil responses were recorded, up from the 366 in 2003/04. A total of 372 companies therefore responded (either by completing and returning a questionnaire or through telephonic communication) representing a response rate of 59 percent for the 2004/05 survey. It appears that the length and design of the questionnaire reduced response rates from the 69 percent recorded in 2003/04.

Apart from the length of the survey questionnaire, which was the primary concern in the business sector, the high turnover rate of staff within CeSTII added capacity constraints to the business sector. Further resources are required if the sector is to continue to grow its output.

The use of telephonic interviews, historical data and imputations proved successful in rounding off the survey. It is envisaged that the next (2005/06) business sector R&D survey be supplemented by the Survey Call Centre telephonically surveying the many small businesses that do some R&D but are missed in the main survey.

## **2.2) The Higher Education Sector**

Although the Higher Education landscape has undergone significant changes due to institutional mergers, the Higher Education Sector registry has remained relatively unchanged from that of the 2003/04 survey. Due to the fact that data pertaining to the 2004 academic year is of relevance to the current survey, most institutions were surveyed in their original form. Next years survey, however, should reflect the new institutional landscape more closely.

Choice in terms of unit of measure was again varied across the sector, although the majority of institutions preferred to collect data centrally. In most cases, this method has proved successful. Problems did, however, arise, when the person responsible for completing the survey on behalf of the university lacked authority to request information from the various operational units within the institution. In response to this, it has been decided that the relevant Dean of Research or Vice Chancellor be required to sign off on the survey prior to the data being captured by the HSRC.

Response rates to the survey have generally improved since last year and respondents have taken significantly less time to complete the questionnaire. This, it seems, is largely due to improved explanatory notes included in the questionnaire and strengthened relationships with the Higher Education respondents. Prior to the launch of the survey, workshops were held in both Cape Town and Pretoria to sensitise respondents to the survey. It appears that this initiative has paid off since most respondents believe the data for 2004/05 to be more reliable than that collected previously.

Seven relatively low research-intensive institutions failed to submit returns. The primary reason for this seems to be that the data are simply not available in the form required by the survey. In these cases, use was once again made of supplementary data sources including HEMIS, the NRF, MRC, THRIP and the Innovation Fund. Once questionnaires for these institutions had been populated, they were sent to the Research Dean at the particular institution for signing off. In most cases, it appears that the supplementary data calculations done by HSRC staff have closely approximated the total R&D expenditures suggested by the Research Deans.

A thorough data verification process was also initiated in November 2005, where data received from all institutions was compared against data received from HEMIS, the NRF, Innovation Fund and THRIP. Again, data calculations done by HSRC staff closely approximated the R&D expenditures received from the HE institutions. The verification process has also revealed greater consistency within the sector in terms of interpretation of the questionnaire and fewer outliers within the data.

It is envisioned that the burden on respondents be reduced during the next survey by making extensive use of HEMIS data across the sector. This should ensure even greater consistency within the sector.

### **2.3) The Science Council Sector**

Survey methodology employed in the Science Council Sector remained unchanged from that of last year. The majority of Science Councils completed the questionnaire at the level of organisation, while the NRF and the ARC completed the questionnaire at the level of unit or facility. This proved problematic once again, since poor coordination of the survey within these institutions resulted in a number of late returns. This demanded considerable "follow-up" work on the part of CeSTII staff who needed to liaise directly with Directors of the research units and facilities concerned.

It appears that the R&D terms and concepts included in the survey questionnaire and user guide are generally well understood by respondents in the Science Council Sector. During the 2003/04 survey, for instance, considerable difficulties regarding the interpretation and calculation of Full-Time Equivalents was experienced and respondents had to be assisted. No respondents reported such problems for the current 2004/05 survey.

### **2.4) The Not-For-Profit Sector**

The NPO sector still accounts for the smallest proportion of the total R&D expenditure across all the sectors in South Africa.

Thirty five percent of the 107 questionnaires originally sent out were returned. Of these, 84 percent reported R&D activity.

The 2004/05 survey reflects a slight decrease in R&D expenditure for the sector from that of last year. Despite the fact that several new NGO's were identified and added to the register, a definite decrease in active, potentially R&D performing organisations was noted.

The reasons for this decrease can generally be ascribed to the following:

- Many NGO organisations closed down or phased out their research activities over the last year
- Some Section 21 Organisations were handed over to the business sector

- Although registered as NPO organisations, many NPOs are housed by universities. As a result, their R&D activities are included in the Higher Education Sector expenditure
- Many organisations on the NPO registry were/are untraceable
- Numerous NPO's informed that they fund research and do not conduct research
- Many NPO's are of the opinion that the research they conduct is not compliant with the Frascati definition of R&D and that the survey is therefore not relevant to them.
- Capacity constraints on the part of the respondent

## **2.5) The Government Sector**

The government sector, comprising national institutes, national museums and national and provincial government has displayed an increase in R&D expenditure from that recorded during the last survey. The number of Research Institutes on the government registry increased from that of last year, but research expenditure for the sub-sector decreased. The increase in the number of responses from national and provincial government has therefore contributed to the increase in government sector expenditure on R&D.

Respondents in the sector have shown a definite improvement with regards to the understanding and calculation of key concepts and terms included in the questionnaire and User Guide. As a result, fewer incorrect questionnaires were returned. Due to the high turnover rates in government, however, CeSTII staff again spent considerable time finding appropriate persons to fill out the questionnaire and educating them on Frascati methodology.

## **3) Key Recommendations and new developments**

- As mentioned previously, Business Sector response rates were significantly lowered by the length of the survey questionnaire and the subsequent burden on respondents. Since the use of historical data and imputation methods has proved both useful and successful, it is recommended that the next (2005/06) business sector survey make use of these methods with firms that have been reluctant to respond and also to telephonically survey a whole new range of small firms.
- The response rate in the business sector could also be improved with the use of a shorter questionnaire and enhanced questionnaire design. Since the Higher Education Workshops proved so successful in informing the re-design of the HE questionnaire, it may be a good idea for the business to initiate a similar exercise.
- In the light of tax credit system re-design, we recommend that CeSTII engage with key stakeholders in the system in order to define CeSTII's role as possible verifier of R&D expenditure information. The possible implications this holds for CeSTII will need to be scoped and discussed.

- CeSTII seeks to further expand the registry of South African R&D organisations by entering into discussions with numerous local stakeholders. Such discussions would include the following:
  - Discussions need to be held with the Industrial Development Corporation of South Africa (IDC), the National Research Foundation (NRF) and the Department of Trade and Industry (DTI) regarding the new information that now has to be written into new grant contracts and the implications this could hold for data collection.
  - Discussions should be entered into with the Department of Agriculture regarding the possible release of names of Organisations to whom they are granting licenses to conduct field research into genetic modification.
  - Similar discussions should be entered into with the Medical Controls Council regarding the organisations to which they issue licenses to conduct clinical trials in South Africa.

PAGE 8: Fig 1

Since 2001, R&D expenditure has grown both in nominal and real terms. Between 2003/04 and 2004/05 total R&D expenditure in South Africa grew from just over 10 billion Rand to 12 billion Rand in nominal terms representing a real annual increase of about 12.8%. This increase is partly due to a general increase in survey coverage, particularly of the business and higher education sectors as well as increased funding from government sources.

SOURCE: South African National R&D Surveys

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

PAGE 10: Fig 2

The increase in gross expenditure on R&D (GERD) in real terms since 2003 has resulted in an increase in GERD expressed as a percentage of GDP. The data suggest a steady increase in GERD as a percentage of GDP from 0.69% in 1997 to 0.87% in 2004. Although the research system appears to have grown considerably since 1997, the challenge to reach the R&D expenditure goal of 1% of GDP by 2008 remains.

SOURCE: South African National R&D Surveys

PAGE 12: Fig 3

Although South African GERD as a percentage of GDP has increased between 2001 and 2003, it has not kept pace with countries such as China and Russia that have shown regular increases in GERD expressed as a percentage of GDP since 1995. China remains the country with the fastest growing research intensity, reflecting an increase from 1.07% of GDP in 2001 to 1.44% of GDP in 2004.

SOURCE: International comparisons – OECD Main Science and Technology Indicators, (2005/2 Edition)

PAGE 14: Fig 4

At a level of 1.6 FTE researchers per 1 000 total employment (across all economic sectors), South Africa has a relatively low number of researchers when compared with other countries. The 2004/05 survey reflected a total of 17 910 FTE researchers in South Africa, of which approximately 38% comprised doctoral students and post-doctoral fellows.

SOURCE: International comparisons – OECD Main Science and Technology Indicators, (2005/2 Edition)

PAGE 16: Fig 5

South Africa was one of the first countries to provide data on women in national R&D statistics. Between 2001 and 2004 women researchers as a percentage of total researchers in South Africa increased by 3.4%, indicating that the country is making progress in terms of gender representivity within the field of research and experimental development. Of those countries that do report on women in R&D, Argentina and Russia continue to lead the way, while countries such as South Korea and Japan still lag behind.

SOURCE: International Comparisons – OECD Main Science and Technology Indicators (2005/2 Edition)

PAGE 18: Fig 6

When comparing the percentage of women researchers across the various sectors in South Africa, disparities become evident. The not-for-profit sector displays the largest percentage of women researchers, followed by the higher education sector, government (including the Science Councils) and the business sector.

SOURCE: South African National Research and Experimental Development Survey 2004/05

PAGE 20: Fig 7

The business sector accounts for 56.3% of R&D expenditure in South Africa, followed by the higher education sector (21.1%). The government sector (including Science Councils) accounted for 20.9% of total R&D expenditure and the not-for-profit sector 1.7%. The increase in the percentage of R&D performed by the business and higher education sectors since 2003 is mostly accounted for by the greater coverage attained within these sectors by the 2004/05 survey.

SOURCE: South African National Research and Experimental Development Survey 2003/04 and 2004/05

PAGE 22: Fig 8

The business sector is the largest performer of R&D in South Africa and receives substantial funding from foreign business sources. As the second largest funder in South Africa, the government sector funds approximately R4 billion (39.5%) of R&D activity in South Africa. About 18% of total funds are provided by foreign sources (up from the 10% in 2003/04). Sources of funds are reported as disclosed by survey respondents. Funds attributed to "Other SA" sources are from cases where respondents did not account for the sector of the source of certain funds used in the performance of their R&D.

PAGE 24: Fig 9

In 2004 the largest proportion of R&D in South Africa took place in fields related to the engineering sciences (23.9%) followed by the natural sciences (20.8%) and the medical and health sciences (14.8%). The social sciences and humanities accounted for a further 12.4% of R&D expenditure in South Africa.

Between 2003 and 2004, expenditure on R&D in the fields of information, computer and communication technologies increased by 24.8% while the applied sciences and technologies experienced a 2.9% decline in R&D expenditure. The medical and health sciences showed an increase in R&D expenditure of 21.6% for the period.

SOURCE: South African National Research and Experimental Development Surveys 2003/04 and 2004/05

PAGE 26: Fig 10

In the 2003/04 R&D Survey, pure basic research and strategic basic research together accounted for 24.2% of total R&D expenditure. In the interest of simplicity, for the 2004/05 R&D Survey the category of strategic basic research was dropped from the questionnaire and this move could partly be responsible for the drop in reported basic research to 18.6%. R&D expenditure devoted to applied research accounted for the largest proportion of R&D in South Africa in 2003/04 but in 2004/05 expenditure on Experimental Development accounted for the bulk (42.6%) of R&D expenditure.

PAGE 28: Fig 11

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. South Africa's expenditure on basic research of 0.16% of GDP is slightly down from the 0.19% recorded in 2003. Most countries reflected in the graph have had a relatively stable percentage of GDP devoted to basic research over the past decade, with France topping the list with 0.53% of GDP devoted to basic research.