South Africa’s Research and Development Profile

What are the main features of the South African research and innovation system? Who does research in the country? In which fields does South Africa perform research? Are there indicators showing the openness of the South African Innovation System? These and other questions will be addressed in this R&D Profile in order to provide European researchers interested in South Africa with an overview on the context in which their potential collaborations with South African institutions will be developed.

This section presents information obtained through interviews that were conducted in South Africa between November 17 and December 16 (2010) as well as statistical information from documents provided by the interviewees. The interviewees were managers of South African research and innovation programmes. This information has been completed and verified through a desktop study whose main sources are listed at the end of the document.

Analyses are presented in 2 parts:

- A set of indicators that shows South African R&D activity compared, where possible, to other countries and regions;
- A description of the R&D performers and their contribution to the national R&D activity.
Key facts and Indicators

Gross Domestic Expenditure on R&D (GERD)

In 2008/2009\(^1\) the GERD was equivalent to **21 041 Million Rands** which represent **0.92% of the Gross Domestic Product (GDP)**\(^2\). In South Africa the total amount of the GERD has increased continuously between 1997/98 and 2008/09. An increase of 1.3% (real terms) was registered between 2007/08 and 2008/09, from 18 624 Million in 2007/08 to 21 041 Million in 2008/09. The GERD as a percentage of GDP has also steadily increased between 1997/98 and 2006/07 (0.93% in this fiscal year) but a first slight decrease has been showed in the 2008/09 (-0.01%).

As Brazil in Latin America, South Africa is the country with the major R&D Expenditure in its region. In 2005, Africa accounted for 0.7% of the world share of R&D expenditure, South Africa representing 0.5% of the region’s share. In the same year Brazil accounted for 1.3% of the Latin America share (2.4%)\(^3\).

GERD as a percentage the GDP in other countries were as follows in 2008\(^4\):

- Brazil: 1.1%
- Europe (average 2007): 1.77%
- OCDE (average 2007): 2.28%
- United States: 2.8%
- Japan: 3.44%
- Sweden: 3.75%

The Government is the main funder of R&D in South Africa with 45.7% of the GERD, while the business sector contributes with 42.7% of the GERD. This structure for funding is more common in developed countries given the key role played by the business sector. As observed in figure 1, countries and regions with high GERD show a high contribution of industries to the GERD\(^5\).

---

4. OECD, Science,Technology and Industry Outlook 2010. URL: http://www.oecd.org/document/36/0,3343,en_2649_34273_41546660_1_1_1_1,00.html#contents
5. OCDE, Main Science and Technology Indicators (MSTI): 2010/1 edition http://www.oecd.org/document/26/0,3746,en_21571361_31938349_1901082_1_1_1_1,00.html
With regards to R&D Expenditure by research fields (Figure 2), in South Africa around 70% of the GERD is dedicated to Engineering Sciences (24.4%), Natural Sciences (20.6%), Medical and Health Sciences (14.8%) and Information and communication technologies (13.1%). The latter showed a slight decrease compared to its share of R&D Expenditure in 2008/07. The Expenditure in Social Sciences and Humanities remained stable at 12.5%.

HSRC, National Survey of Research and Experimental Development, 2008/09
Figures 3, 4, 5 and 6 show the R&D expenditure in 2007/08 by R&D performers (except the Non-for-Profit organisations). It should be especially noted that:

- More than 70% of the business enterprise sector R&D expenditure is devoted to Engineering Sciences, Medical and Health Sciences, Information computer and communication technologies and Applied Sciences and technologies. This pattern is consistent with the distribution of total R&D expenditure.

- Government R&D expenditure is currently distributed differently: more than 50% of the expenditure is dedicated to Social, Agricultural and Medicine-Health Sciences. Hearth Sciences (14%) and biological Sciences (9.8%) represent also an important field for the Government R&D expenditure.

- With regards to universities, more than 50% of the R&D expenditure is dedicated to Social (22%), Medical-Health Sciences (21.7) and Humanities (12%). 8.1% of the expenditure is devoted to Engineering Sciences and 7.5% to Biological Sciences.

- In the business sector, Engineering Sciences represented the more funded field for Sciences Councils R&D expenditure (22.3%), followed by the Agricultural Sciences (19.6%) and the Medical-Health Sciences (12.4%).

---

**FIGURE 3**

*Business R&D Expenditure by research field, 2007/08*

- Engineering: 30.1
- ICT: 20.3
- Physical: 4.7
- Chemical: 5.4
- Agricultural: 2.9
- Social: 3.5
- Material: 1.7
- Medical-Health: 11.8
- Biological: 1.5
- Math. Sc: 1.6
- Earth: 0.9
- Environmental: 0.6
- Marine: 0.1
- Humanities: 0

HSRC, National Survey of Research and Experimental Development, 2008/09
FIGURE 4

Government R&D Expenditure by field, 2007/08

- Medical-Health: 15.1
- Social: 20.4
- Agricultural: 18.1
- Medical-Health: 15.1
- Physical: 3.9
- Environmental: 0.7
- Marine: 0.6
- Material: 0.1

HSRC, National Survey of Research and Experimental Development, 2008/09

FIGURE 5

Universities R&D expenditure by research field, 2007/08

- Medical-Health: 21.7
- Humanities: 2
- Engineering: 8.1
- Biological: 7.5
- Agricultural: 4.4
- Chemical: 4
- Physical: 4.1
- ICT: 3.3
- Earth: 3.4
- Math. Sc: 3
- Applied Sc and Tech: 2.7
- Marine: 0.2

HSRC, National Survey of Research and Experimental Development, 2008/09
FIGURE 6

Research Councils R&D Expenditure, 2007/08

Medical-Health; 12.4

Agricultural; 19.6

Engineering; 22.3

Marine; 0.7

Math. Sc; 1.2

Humanities; 0.9

Chemical; 1.3

Environmental; 3

Physical; 3.2

Material; 3.7

Applied Sc and Tech.; 4.8

Earth; 5.1

Biological; 6.1

ICT; 7.4

Social; 8.2

HSRC, National Survey of Research and Experimental Development, 2008/09
Researchers

In 2008, South Africa had a total of 19 320 researchers\textsuperscript{6} full time equivalent (FTE) representing 1.41 researchers per 1 000 employees. Other countries’ or regions’ numbers of researchers for the same period as follows:

\begin{itemize}
  \item Mexico: 37 930 researchers
  \item China: 1 592 420 researchers
  \item OCDE: 4 128 008 researchers
  \item Europe (EU27): 1 494 093 researchers
  \item United States: 1 412 639 researchers\textsuperscript{7}
\end{itemize}

According to Gaillard (2010)\textsuperscript{8}, estimates suggest that in 2005 FTE researchers in South Africa represented 0.3% of the world share and more than 13.8% of the FTE scientists in Africa. He explains that the increase in the number of scientists in Africa between 1998 and 2003 (+52%) would be explained essentially by the augmentation of FTE researchers in South Africa (+66%).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{researchers.png}
\caption{Researchers per thousand total employment, 2007}
\end{figure}

\begin{footnotesize}
\textsuperscript{6} Human Sciences Research Council (HSRC), National Survey of Research and Experimental Development (2008/2009 Fiscal Year), September 2010, Page 7.
\textsuperscript{7} OECD, Science, Technology and Industry Outlook 2010. URL: http://www.oecd.org/document/36/0,3343,en_2649_34273_41546660_1_1_1_1,00.html#contents.
\end{footnotesize}
Since the early 1980s, business researchers have grown faster than total industrial workers in the OECD area. Although the low proportion of researchers in business enterprises per thousand employment in South Africa compared to developed countries or regions (0.5 researchers per thousand employment in South Africa, 3 in the EU27, 4.8 in the OECD area, 7.7 in the USA - Figure 7), the number of business researchers has progressed strongly in this country between 1997 and 2007 at an average annual rate of 19% (Figure 8). This is five times the increase in Europe for the same period and the highest increase registered by the OECD after Portugal (21.9%), well above the OECD average (3.3%).

**Figure 8**

Growth of business researchers, Average annual growth rate, 1997-2007

<table>
<thead>
<tr>
<th>Country</th>
<th>Average Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States (1997-2006)</td>
<td>2.4%</td>
</tr>
<tr>
<td>OECD (1997-2006)</td>
<td>3.3%</td>
</tr>
<tr>
<td>EU27</td>
<td>3.7%</td>
</tr>
<tr>
<td>China (2000-07)</td>
<td>15.1%</td>
</tr>
<tr>
<td>South Africa (2001-05)</td>
<td>18.9%</td>
</tr>
<tr>
<td>Portugal</td>
<td>21.9%</td>
</tr>
</tbody>
</table>

OECD Science, Technology and Industry Scoreboard 2009

---

In 2008/09, women represented 39% of total researchers in South Africa\(^\text{10}\), more than in France (27.4%), for example. 73% of woman researchers in South Africa are employed in the higher education sector while their representation in the business sector is only of 29.5% of total researchers\(^\text{11}\).

**FIGURE 10**

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage of woman researchers, 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>51.5</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>41.8</td>
</tr>
<tr>
<td>South Africa</td>
<td>39.7</td>
</tr>
<tr>
<td>Spain</td>
<td>37.0</td>
</tr>
<tr>
<td>Norway</td>
<td>33.4</td>
</tr>
<tr>
<td>Ireland</td>
<td>32.1</td>
</tr>
<tr>
<td>France</td>
<td>27.4</td>
</tr>
<tr>
<td>Japan</td>
<td>13.0</td>
</tr>
</tbody>
</table>

Human Sciences Research Council (HSRC), National Survey of Research and Experimental Development, 2010

South Africa has a total of 1,274 doctoral graduates or 26 doctorates per million of the country’s population\(^\text{12}\). This is a low performance compared to other countries (see below) and one of the major challenges of the South African system.

**FIGURE 9**

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Doctorates per million of total country population in 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>13</td>
</tr>
<tr>
<td>South Africa, 26</td>
<td>52</td>
</tr>
<tr>
<td>Brazil, 11</td>
<td>62</td>
</tr>
<tr>
<td>France, 62</td>
<td>162</td>
</tr>
<tr>
<td>US, UK, 268</td>
<td>261</td>
</tr>
<tr>
<td>Germany, 297</td>
<td>288</td>
</tr>
<tr>
<td>Sweden, 427</td>
<td>427</td>
</tr>
<tr>
<td>Switzerland, 564</td>
<td>564</td>
</tr>
<tr>
<td>Port.; 569</td>
<td></td>
</tr>
</tbody>
</table>

ASSAF, The PhD study, 2010

---

\(^\text{10}\) HSRC, Idem.

\(^\text{11}\) HSRC, Idem.

\(^\text{12}\) Academy of Science of South Africa (ASSAF), *The PhD Study*, September 2010.
Scientific publications

With regards to scientific publications, only three African countries are among the top twenty publishing countries in Asia (excluding Japan), Latin America and Africa\(^{13}\). They are South Africa, Egypt, Morocco and Tunisia.

In the African continent, scientific production is dominated by South Africa with 47,000 papers produced between 1999 and 2008. In the same period, Egypt -who leads North African scientific publications- produced 30,000 papers while Nigeria - leading the middle Africa region- produced 10,000 papers\(^{14}\).

As a share of world publications, the highest African performance is for South Africa in the field “Plant and Animal Science” (1.55%) followed by the same country’s percentage of “Environment/Ecology” (1.29%)\(^{15}\).

In 2008, South Africa published 110 scientific articles per million population. While relatively low compared to other countries, South Africa’s scientific publications have grown by an annual average of 4.5% since 1998\(^{16}\). Publications abroad are as follows:

→ Brazil: 141 per million population (26,806 in total)
→ United States: 911 per million population in 2008 (277,446, the highest in the world)

Although Africa’s total scientific publications are lower than Brazil’s\(^{17}\), the impact factor of South Africa’s publications is above China, Brazil and the Latin America average\(^{18}\). The impact factor reflects the average number of citations to articles published in science and social science journals.

Finally, it is noteworthy that the number of articles co-published in South Africa with European co-authorship has not stopped increasing since 1987 and is above the total of articles co-published with other countries since 1997 (Figure 10 and Table 1)\(^{19}\).


\(^{15}\) Thomson Reuters, Global Research Report, Africa, April 2010.

\(^{16}\) OECD, Science,Technology and Industry Outlook 2010. URL: http://www.oecd.org/document/36/0,3343,en_2649_34273_41546660_1_1_1_1,00.html#contents


\(^{18}\) Idem, Page 98.

FIGURE 10


TABLE 1

ARTICLES WITH INTERNATIONAL CO-AUTHORSHIP IN SOUTH AFRICA (1987-2008)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>With EU</td>
<td>191</td>
<td>186</td>
<td>203</td>
<td>224</td>
<td>249</td>
<td>273</td>
<td>289</td>
<td>313</td>
<td>380</td>
<td>415</td>
<td>514</td>
<td>537</td>
</tr>
<tr>
<td>Without EU</td>
<td>303</td>
<td>266</td>
<td>266</td>
<td>247</td>
<td>276</td>
<td>293</td>
<td>320</td>
<td>395</td>
<td>396</td>
<td>441</td>
<td>434</td>
<td>505</td>
</tr>
<tr>
<td>With Nationals</td>
<td>3260</td>
<td>3189</td>
<td>2626</td>
<td>2433</td>
<td>2496</td>
<td>2392</td>
<td>2451</td>
<td>2356</td>
<td>2463</td>
<td>2171</td>
<td>2155</td>
<td>2103</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>With EU</td>
<td>514</td>
<td>537</td>
<td>620</td>
<td>669</td>
<td>789</td>
<td>782</td>
<td>820</td>
<td>946</td>
<td>994</td>
<td>1164</td>
<td>1293</td>
<td>1161</td>
</tr>
<tr>
<td>Without EU</td>
<td>434</td>
<td>505</td>
<td>546</td>
<td>560</td>
<td>552</td>
<td>650</td>
<td>699</td>
<td>781</td>
<td>835</td>
<td>852</td>
<td>954</td>
<td>986</td>
</tr>
</tbody>
</table>

Thomson Reuters, analysis by IRD
International cooperation and openness of the system

Different indicators confirm the increasing internationalisation of the South African S&T system.

In 2007, foreign students represent more than 7% of enrolment in public South African universities. **27% of doctoral graduates in 2007 were non South Africans** and among them 18% came from other African countries. The percentage of foreign doctoral graduates in South Africa in 2007 is superior to the share of foreign doctoral students (2006) in Japan (16.8%), Sweden (20.6%) and United States (26.3%).

![Figure 11](image)

According to *The PhD Study* published by the Academy of Sciences of South Africa (ASSAF, 2010), **the number of non South African doctoral graduates has increased significantly from 86 in 2000 to 338 in 2007**. The same report indicated that a third of non South-African doctoral students intend to stay in South Africa after graduation, especially students from the SADC.

---

**Notes:**


23. Academy of Sciences of South Africa (ASSAF), *The PhD Study*, September 2010
The Open Doors Report on International Educational Exchange 2010\(^{24}\), which evaluates annually the destination of Americans studying abroad, informed that \textbf{South Africa is among the 25 top destinations of American students} with an increase of 12\% compared to the previous year.

The openness of the South African S&T system is also demonstrated by the increasing percentage of co-publications with international co-authorship, especially with Europe, as presented above in Table 1. Co-publications produced only with national co-authorship dropped from 87\% in 1987 to 45\% in 2008. At the same time, \textbf{co-publications with Europe increased from 5\% to 30\%} of articles with co-authorship and co-publications with other countries passed from 8\% to 25\%\(^{25}\).

In addition, \textbf{11.16\% of South African applications filed under the Patent Co-operation Treaty (PCT) involved international co-invention}. This percentage is above the OECD average (7.7\%) and it is still over the EU27 (10.82\%) and USA (10.84\%) percentage of PCT applications with co-inventions (Figure 12).

As an interesting indicator, it was established by the OECD\(^{26}\) that among the South African patent applications filed under the Patent Co-operation Treaty (PCT) that involved international co-invention (PCT patent applications with co-inventors located abroad), \textbf{Europe represent the most important partner in co-inventions among the three major regions} (USA, Europe, Japan) with 5.19\% in comparison with the United States (3.2\%) and Japan (0.07\%). Figure 13 shows this comparison.

![Figure 12](http://www.oecd-ilibrary.org/sites/sti_scoreboard-2009-en/01/10/index.html?contentType=ns/Book//ns/StatisticalPublication&itemId=content/book/sti_scoreboard-2009-en&containerId=content/serial/20725345&accessItemsId=)
Compared to the BRIC (Brazil, Russian Federation, India, China), South Africa has the highest percentage of co-inventions registered with Europe (47%) followed by Brazil (43%). On the contrary, the percentage of co-inventions with Europe is considerably less important for China and India where the co-inventions with the United States represent 48% and 63% of total co-inventions with partners located abroad\(^\text{27}\). See Figure 13.

\[\begin{array}{lccccccc}
\text{Brazil} & 40\% & 15\% & 2\% & 4\% \\
\text{Russian Federation} & 39\% & 34\% & 4\% \\
\text{India} & 63\% & 13\% & 1\% \\
\text{China} & 48\% & 29\% & 16\% & 7\% \\
\text{South Africa} & 47\% & 29\% & 24\% & 1\%
\end{array}\]

\(\text{FIGURE 13}\)

PCT patent applications with co-inventors located abroad, 2004-06

OECD, Science, Technology and Industry Scoreboard 2009

\[\text{OECD, Science, Technology and Industry Scoreboard 2009.}\]

\[\text{OECD, Science, Technology and Industry Scoreboard 2009.}\]

\[\text{OECD, Science, Technology and Industry Scoreboard 2009.}\]
Regional impact

As a result of the openness of South African universities, the country is playing a dynamic role in Africa, especially in the Southern region, contributing to the capacity building of students from other African countries.

South Africa is the second among the Top 10 host countries for African students. In fact, South Africa (which hosts 55,405 African students in 2008) is only behind France (104,823 African students) and ahead United States (33,924) and UK (30,884) among others. In the period between 2003 and 2008 the number of African students in South Africa increased up to 29, 2%.

It should be noted that there is a high representation of non-South African doctoral graduates among the black doctoral graduates. In 2007, 338 of the 405 black doctoral students in South Africa were non South African. In the same year, 27% of the doctoral students in South Africa were from abroad. Among them 9% comes from the Southern Africa Development Community (SADC) and 9% comes from other African Countries.

For European researchers and institutions this can be an attractive factor since their cooperation with South African partners can have an impact at the regional level. However, the appeal of South Africa for high skilled students from other African countries can lead to brain drain in least developed African countries.

---

28 Campus France, International Student Mobility: Key Figures, 2010
29 The SADC SADC has a membership of 15 Member States: ; Angola, Botswana, Democratic Republic of Congo (DRC), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, United Republic of Tanzania, Zambia and Zimbabwe.
Research and innovation performers within the National Innovation System

In this part, the research and innovation performers are described according to the classification of the OECD, also used by the Human Science Research Commission (HSRC) in charge of the National Survey of Research and Experimental Development in South Africa. Where possible, this section updates analysis of the “Review of innovation policy: South Africa” prepared by the OCDE in 2007.

Business enterprise sector

58.6 % of the R&D expenditure in South Africa (2008/09) 30
39.7 % of R&D personnel (FTE) 31
31.30% of researchers (FTE) = 6 047.5 researchers (FTE) 32

The business enterprise sector is the highest R&D performer in South Africa in terms of R&D Expenditure: the private sector’s of the R&D expenditure is 58.6%, and has been increasing in the past few years. It increased from 8 243 millions Rands in 2005/06 to 12 332 million Rands in 2008/09.

The business enterprise expenditure in R&D (BERD) is funded essentially by private companies (67.62%) but also by the government (20.81%) and foreign sources (11.32%). The BERD is allocated for the bulk to Experimental research (62.7%) 33.

The OECD Science, Technology and Industry Outlook 2010 emphasises the increase in the country’s trade in high technology by 4 percentage points between 1997 and 2007. In addition, it pointed out that during 2002-04, 61% of firms in South Africa engaged in non-technological innovations, i.e. marketing and organisational innovations that go along with a new production techniques or the commercialisation of new products. Finally the report highlighted that for the same period, 21% of firms introduced new-to-market product innovations, being above the OECD average.

---

32 Idem, page 8.
33 HSRC, National Survey of Research and Experimental Development: 2007/08, Page 56 and 57.
Higher education sector

The higher education sector consists of more than half of researchers full-time equivalent (FTE) and 69.23% of researchers’ headcount in South Africa (27 752 researchers among the 40 084 researchers’ headcount). However, the share of R&D expenditure in this sector (19%, 4 191 millions rands) is around 30% lower than in the Business enterprise sector (58.6%)\(^{37}\).

The R&D personnel FTE – researchers, technicians and other personnel directly supporting R&D - in the higher education sector (36.7%) is slightly lower compared to the business sector R&D total personnel (39.7%)\(^{38}\).

Universities perform an important activity of basic research (47.2% of the total universities’ expenditure in R&D), but also applied research (34.9%). Unlike business research, experimental research seems to be less important in Universities with only 17.9% of their R&D expenditure.

The R&D expenditure of the higher education sector is funded essentially by the government (76.99%) but the higher education sector also receives funding from the business sector (10.83%), foreign partners (9.7%) and others (2.38%).

The higher education sector consists of 23 Universities classified into three groups:

**Traditional universities**

University of Cape Town: [http://www.uct.ac.za/](http://www.uct.ac.za/)
University of Fort Hare: [http://www.ufh.ac.za/](http://www.ufh.ac.za/)
University of the Free State: [http://www.ufs.ac.za/](http://www.ufs.ac.za/)
University of KwaZulu-Natal: [http://www.ukzn.ac.za/Homepage.aspx](http://www.ukzn.ac.za/Homepage.aspx)
University of Limpopo: [http://www.ul.ac.za/](http://www.ul.ac.za/)
North-West University: [http://www.nwu.ac.za/](http://www.nwu.ac.za/)
University of Pretoria: [http://web.up.ac.za/](http://web.up.ac.za/)
Rhodes University: [http://www.ru.ac.za/](http://www.ru.ac.za/)
University of Stellenbosch: [http://www.sun.ac.za/](http://www.sun.ac.za/)
University of the Western Cape: [http://www.uct.ac.za/](http://www.uct.ac.za/)
University of the Witwatersrand: [http://web.wits.ac.za/](http://web.wits.ac.za/)

---

\(^{34}\) National Survey of Research and Experimental Development 2008/09 Fiscal Year, Page 21
\(^{35}\) HSRC, National Survey of Research and Experimental Development: 2007/08, Page 8.
\(^{36}\) HSRC, National Survey of Research and Experimental Development: 2007/08, Page 8.
\(^{37}\) National Survey of Research and Experimental Development 2008/09 Fiscal Year, page 23
\(^{38}\) HSRC, National Survey of Research and Experimental Development: 2007/08, Page 37
Comprehensive universities

University of Johannesburg: http://www.uj.ac.za/EN/Pages/home.aspx
University of South Africa: http://www.unisa.ac.za/
Nelson Mandela Metropolitan University: http://www.nmmu.ac.za/Default.asp?bhcp=1
University of Venda: http://www.univen.ac.za/
Walter Sisulu University for Technology and Science: http://www.wsu.ac.za/
University of Zululand: http://www.uzulu.ac.za/

Universities of technology

Cape Peninsula University of Technology: http://www.cput.ac.za/
Central University of Technology: http://www.cut.ac.za/
Durban University of Technology: http://www.dut.ac.za/site/default.asp
Mangosuthu University of Technology: http://www.mut.ac.za/
Tshwane University of Technology: http://www.tut.ac.za/
Vaal University of Technology: http://www.vut.ac.za/new/

As explained below, South African universities receive a huge number of international students each year. Universities are greatly attractive to European researchers and they are a key entry point for scientific cooperation with this country (this aspect will be further discussed in the D2.3). Many South African universities are world-class and three of them are included in the Academic Ranking of World Universities 2010:

<table>
<thead>
<tr>
<th>Institution</th>
<th>National Rank</th>
<th>Regional Rank (Africa)</th>
<th>World Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Cape Town</td>
<td>1</td>
<td>1</td>
<td>201-300</td>
</tr>
<tr>
<td>University of the Witwatersrand</td>
<td>2</td>
<td>2</td>
<td>301-400</td>
</tr>
<tr>
<td>University of KwaZulu-Natal</td>
<td>3</td>
<td>3</td>
<td>401-500</td>
</tr>
</tbody>
</table>

A characteristic of the South African higher education sector is the concentration of resources and doctoral students in a small number of universities. 5 of the 24 universities presented in the report 2007/08 of the HSRC (Cape Town, Witwatersrand, KwaZulu-Natal, Pretoria and Stellenbosch) concentrate more than 65% of the total universities’ R&D Expenditure, more than 50% of researchers and 56% of total doctoral students. The table 3 shows the percentage of R&D expenditure, the number of researchers and doctoral students for 24 universities.

---

39Academic Ranking of World Universities http://www.arwu.org/ARWU2010_2.jsp
### TABLE 3

**Universities R&D expenditure, researchers and doctoral students, 2007/08**

<table>
<thead>
<tr>
<th>Universities</th>
<th>% of total Universities R&amp;D expenditure</th>
<th>Researchers (headcount)</th>
<th>Doctoral students (headcount)</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Cape Town</td>
<td>15.79%</td>
<td>2321</td>
<td>1203</td>
</tr>
<tr>
<td>University of the Witwatersrand</td>
<td>15.50%</td>
<td>1630</td>
<td>1105</td>
</tr>
<tr>
<td>University of KwaZulu-Natal</td>
<td>12.85%</td>
<td>1910</td>
<td>1162</td>
</tr>
<tr>
<td>University of Pretoria</td>
<td>11.48%</td>
<td>1996</td>
<td>1585</td>
</tr>
<tr>
<td>University of Stellenbosch</td>
<td>9.99%</td>
<td>1034</td>
<td>1001</td>
</tr>
<tr>
<td>North-West University</td>
<td>6.17%</td>
<td>1328</td>
<td>866</td>
</tr>
<tr>
<td>University of Johannesburg</td>
<td>4.12%</td>
<td>683</td>
<td>565</td>
</tr>
<tr>
<td>University of the Free State</td>
<td>3.93%</td>
<td>193</td>
<td>632</td>
</tr>
<tr>
<td>University of South Africa</td>
<td>3.47%</td>
<td>1106</td>
<td>771</td>
</tr>
<tr>
<td>Nelson Mandela Metropolitan University</td>
<td>2.69%</td>
<td>444</td>
<td>346</td>
</tr>
<tr>
<td>Rhodes University</td>
<td>2.62%</td>
<td>291</td>
<td>256</td>
</tr>
<tr>
<td>University of the Western Cape</td>
<td>2.47%</td>
<td>516</td>
<td>353</td>
</tr>
<tr>
<td>Tshwane University of Technology</td>
<td>1.93%</td>
<td>509</td>
<td>146</td>
</tr>
<tr>
<td>University of Limpopo</td>
<td>1.29%</td>
<td>745</td>
<td>154</td>
</tr>
<tr>
<td><strong>Universities of Science and Technology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cape Peninsula University of Technology</td>
<td>1.17%</td>
<td>171</td>
<td>90</td>
</tr>
<tr>
<td>Durban University of Technology</td>
<td>0.93%</td>
<td>299</td>
<td>53</td>
</tr>
<tr>
<td>Walter Sisulu University for Technology and Science</td>
<td>0.83%</td>
<td>526</td>
<td>13</td>
</tr>
<tr>
<td>Central University of Technology</td>
<td>0.74%</td>
<td>134</td>
<td>59</td>
</tr>
<tr>
<td>University of Zululand</td>
<td>0.59%</td>
<td>231</td>
<td>151</td>
</tr>
<tr>
<td>Vaal University of Technology</td>
<td>0.52%</td>
<td>287</td>
<td>29</td>
</tr>
<tr>
<td>University of Fort Hare</td>
<td>0.31%</td>
<td>292</td>
<td>155</td>
</tr>
<tr>
<td>University of Venda</td>
<td>0.24%</td>
<td>278</td>
<td>49</td>
</tr>
<tr>
<td>Mangosuthu University of Technology</td>
<td>0.11%</td>
<td>37</td>
<td>0</td>
</tr>
<tr>
<td><strong>Private universities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monash University</td>
<td>0.27%</td>
<td>47</td>
<td>0</td>
</tr>
</tbody>
</table>
Research Councils

15.5% of the R&D expenditure in South Africa (2007/08)
16.1% of R&D personnel (FTE)
11.9% of researchers (FTE) = 2 300 researchers (FTE) 

Funded substantially by the responsible Ministry, the research councils are research institutes that perform sector specific-research and, in some cases, act as a funding agency (e.g. the Medical Research Council and the National Research Foundation (NRF)). They may also be responsible for coordinating and setting research priorities that can be considered at the policy level\(^{41}\).

The NRF is included among Research Councils given the fact that this institution manages the National Research Facilities (described below and in D2.3). Since the NRF manages these facilities, it appears within the National Innovation System not only as an “Agency” but also as a “Research and Innovation performer”: 91 researchers\(^{42}\) are part of the NRF’s staff and 446 postgraduates were trained within the facilities\(^{43}\).

There are in total 10 Research Councils—including the Water Research Commission:

- Africa Institute of South Africa (AISA): www.ai.org.za
- Agricultural Research Council (ARC): www.arc.agric.za
- Council for Scientific and Industrial Research (CSIR): www.csir.co.za
- Council for Geoscience (CGS): www.geoscience.org.za
- Human Sciences Research Council (HSRC): www.hsrc.ac.za
- Medical Research Council (MRC): www.mrc.ac.za
- Council for Mineral Technology (Mintek): www.mintek.co.za
- South African Bureau of Standards (SABS): www.sabs.co.za
- National Research Foundation (NRF): www.nrf.ac.za

Research Councils account for 15.5% of the R&D Expenditure in South Africa with 11.9% of researchers FTE. Applied research represents 45.6% of the Research Councils’ expenditure\(^{44}\) while basic research accounts for 27.9% and experimental research for 26.6%. This shows the place for the Science Councils within the Research and Development value chain: they work across all the value chain with an important role in development and technology or knowledge transfer. Compared to other sectors, the Research Councils are between the business sector -which allocate an important share of the R&D expenditure to experimental research - and the universities - for which the basic research represents the most important activity.

\(^{40}\) HSRC, National Survey of Research and Experimental Development: 2007/08, Page 8.
\(^{42}\) National Research Foundation (NRF), Annual Report, 2010, Page 88.
\(^{44}\) HSRC, National Survey of Research and Experimental Development: 2007/08, Page 58.
Government

**6.2 % of the R&D expenditure in South Africa (2007/08)**

6.2 % of R&D personnel (FTE)

3.9% of researchers (FTE) = 757.6 researchers (FTE)

According to the HSRC the South African government is classified as “the national, provincial and local departments; government research institutes; and museums”.

With 3.2% of total researchers, this sector performs 6.2% of the national R&D expenditure. This sector is funded essentially by government contribution including own funds, grants and contracts (74.5%. Own funds represent 63.1%). Some government research institutes are listed under the research councils above.

As explained above, some fields of research are predominant in the government R&D performance: Social Sciences and Humanities (24.3%), Agricultural Sciences (18.1%), Medical and Health Sciences (15.1%) and Earth Sciences (14%).

---

45 HSRC, National Survey of Research and Experimental Development: 2007/08, Page xii.
Documents and sources

University World News, articles concernant l’Afrique du Sud

OECD Science, Technology and Industry Outlook 2010
http://www.oecd.org/document/36/0,3343,en_2649_34273_41546660_1_1_1_1,00.html#contents
http://browse.oecdbookshop.org/oecd/pdfs/browseit/9210051E.PDF

OCDE Review of innovation policy
http://www.oecd.org/document/20/0,3343,en_2649_34273_39294676_1_1_1_1,00.html

Open Doors Report 2010 (USA)

OECD Science, Technology and Industry Scoreboard 2009

OCDE, Main Science and Technology Indicators (MSTI)/ 2010/1 edition
http://www.oecd.org/document/26/0,3746,en_21571361_31938349_1901082_1_1_1_1,00.html

The PhD Report (ASSAF)

Campus France, International Student Mobility: Key Figures, 2010
http://editions.campusfrance.org/chiffres_cles/brochure_campusfrance_chiffres_cles_n5_2010.pdf

Academic Ranking of World Universities
http://www.arwu.org/ARWU2010_2.jsp

Moodie A., SOUTH AFRICA: New funds to boost PhD production, University World News, 12 December 2010

HSRC, National Survey of Research and Experimental Development: 2007/08
http://www.hsrc.ac.za/Page-108.phtml

National Survey of Research and Experimental Development 2008/09 Fiscal Year
http://www.hsrc.ac.za/Page-108.phtml


Thomson Reuters, Global Research Report, Africa, April 2010
http://researchanalytics.thomsonreuters.com/grr/

National Research Foundation (NRF), Annual Report, 2010