

Research & development

A pulse study on the state of water research development in South Africa

In a first of its kind study, the WRC funded an investigation into research and development (R&D) trends in the South African water sector.

Introduction

One of the most efficient and objective methods of assessing research and innovation performance is through scientometric indicators. An indicator is defined as 'statistics of direct normative interest which facilitates concise, comprehensive and balanced judgements about the condition of major aspects of a society. It is in all cases a direct measure of welfare and is subject to the interpretation that, if it changes in the 'right' direction, while other things remain equal, things have gotten better or people are better off.

Currently, indicators are published routinely to inform the relevant authorities of the state of science, technology and innovation internationally. This report elaborates on the indicators that will be useful for monitoring and assessing the state of water research in South Africa, and a bibliometric and patent indicators are developed for water research and invention in the country.

Water research monitoring indicators

Water research monitoring and assessment indicators have been developed to describe the performance of science, technology and innovation of countries and regions. However, disciplinary assessments utilise the same indicators adopted for the particular objectives.

Probably the most often used indicators for disciplinary assessments are those accruing from bibliometrics. In bibliometrics the number of publications in a field is considered as an indicator of research activity. The indicators reported in bibliometric assessments include the number of publications of the assessed unit per year; the share in the world publications; citations received by the assessed unit per year;

citations in comparison with the average publication in the field; comparisons with other institutions or countries of interest; ranking of institutions, countries and so on.

The development of bibliometric indicators requires the identification of an appropriate database. The ISI-Thomson-Reuters databases are the most often used databases for the development of science, technology and innovation indicators. The databases are used internationally by governments and researchers for indicator development and hence they are transparent, researched and assessed on a continuous basis.

The same way in which scientific articles are accepted as a legitimate reflection of scientific research, patents are accepted as a reflection of technological achievements. Patents fulfil two roles. They provide inventors with legal protection for novel products and processes, while simultaneously ensuring that the knowledge of these products and processes becomes available to society.

The third set of indicators of importance for disciplinary assessment is R&D expenditures. The report points out that it is of importance for the field to develop an appropriate methodology to collect the relevant data regularly.

Finally, it is important to monitor the number of post-graduate students in the field of water research.

Bibliometric analysis

Through scrutiny of the number of water research publications with at least one author with South African address for the period 1981-2010 it is apparent that South African researchers were producing about 60 publications a year (Figure 1). During the 2000s the number increased to around

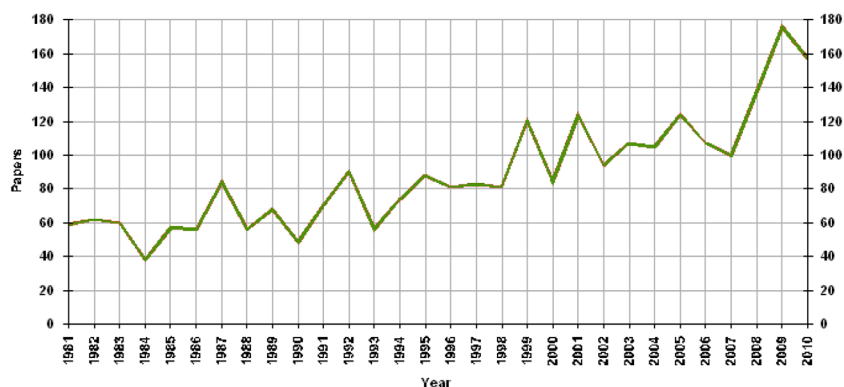


Figure 1
Number of SA water
research publica-
tions 1981-2010

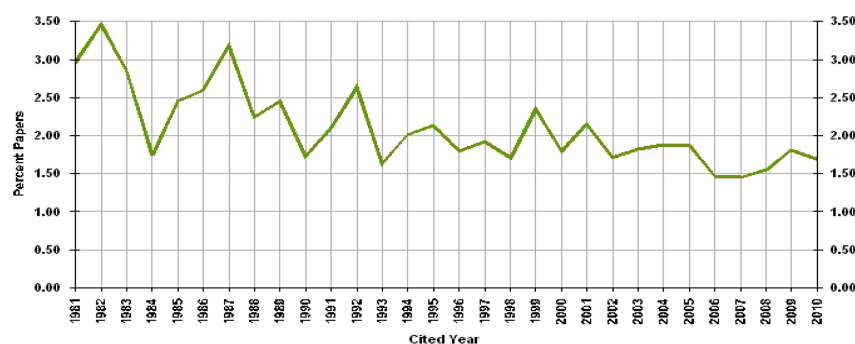


Figure 2
World share of SA
water research
publications
1981-2010

100 publications per year and during 2009 the number jumped to just below 180 publications.

Figure 2 shows the South African share of water research publications in the field. The share appears to have declined from above 3% of the world publications in the beginning of the period to 1.69% during 2010. It is speculated that the South African decline is the result of the increase in coverage of water-related research of the ISI-Thomson-Reuters database, and the increase in the number of publications in other countries.

In terms of the contribution that South Africa makes in selected scientific fields, the country's research is still influenced by the availability of natural resources and the variety of flora and fauna. Examples include the disciplines of mining and mineral processing, ecology, plant sciences, zoology and others. The activity indices show that, in terms of the field of water resources, South Africa is producing almost three times more than the expected from the country's gross research outputs.

South Africa produced 2 323 publications in the field of water research during the period 1999-2012. A large number of these publications were related to environmental sciences and environmental engineering. Certain disciplines that may be of importance for the field e.g. soil science, economics,

management, energy, etc. attracted little research.

Identification of the collaborative patterns in the field shows that South African researchers collaborate most often with researchers in England (3.2% of publications), followed by USA (3.1%), Australia (2.7%), the Netherlands (1.5%), Zimbabwe (1.5%), France (1.3%) and Germany (1.2%).

The University of Pretoria tops the list of institutions most prolific in the field of water research, with 287 publications during the period under review. The University of Cape Town and CSIR follow, with 239 and 183 publications respectively.

In terms of the number of water resources publications produced by various countries during 2006-2010, South Africa ranks 19th in the world (the list is topped by the USA, followed by China). It should be noted that countries with small populations, such as Canada and Australia, as well as countries with relatively small GDP per capita (e.g. India and Brazil) produce more research in the field than South Africa.

The patent analysis also identifies that South Africa produces more inventions in the field of water than the comparator countries proportionally. However, it should be noted that South Africa is granted a very small number of patents generally.

Conclusions

The above findings lead to a number of conclusions. Firstly, water research appears to perform above the average scientific discipline in South Africa. Although a matter for speculation, it can be argued that the focus support by the WRC is, to a large extent, the driving force behind that success. Government can use the WRC success as an example for implementation and institutionalisation in other areas of national priority.

The identified distributed presence of water research in the country, even though a national characteristic, may adversely affect productivity and economies of scale in the field. It will be important for the WRC to examine the issue further and take appropriate action (e.g. establish centres of expertise with critical mass of researchers in focus areas).

The disciplinary emphasis of the country's institutions indicates that researchers move on their own to specific areas without any particular guidance or cognisance of priorities/diversification. It will be important for the WRC to identify research priorities through appropriate approaches (e.g. foresight) and allocated resources accordingly to promising areas. Such an approach will focus resources (human and financial) to areas of importance, and has the potential to bring research closer to application.

Further reading:

To order the report, *A pulse study on the state of water research development in South Africa* (**Report No. 2199/1/12**) contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za, or Visit: www.wrc.org.za to download a free copy.