Water research and development

Finding the right chemistry to grow water science in South Africa

The Water Research Commission (WRC) has completed the first ever comprehensive survey of the state of water research in South Africa.

Lani van Vuuren highlights the most pertinent results.

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In the last 500 years, science has emerged as a central and transformative force that continues to reshape our everyday life. Science does not only help us to understand the world we are living in, it also teaches us how to adapt and thrive in that world.

Science is also an important basis for sound decision-making in many sectors of society. International science and technology cooperation and exchange also play a critical role in narrowing knowledge, information, and technology gaps between countries and societies.

In South Africa, targeted water-related research and resulting scientific discoveries have played a significant role in reducing uncertainties and improving the management of this scarce natural resource. Our improved scientific understanding has also formed the foundation for practical applications that have enhanced the prosperity and security of South African society.

In today's world of threatening climate change and increasing water scarcity, research on water resources has taken on greater importance than ever before.

But how well are we doing in terms of research and innovation? Monitoring and evaluating the various facets of the scientific enterprise is a necessary and integral part of science policy. Rising costs of research and development, coupled with disciplinary claims for financial resources require intelligent allocation of resources, which presuppose knowledge of the activities and performance of the innovation system.

While the National Research and Development Survey and Experimental Development, undertaken annually by the Department of Science and Technology, provides valuable information on various research and development expenditures in various fields, water research is not part of the report's classification schemes.

Thus, for the first time, the WRC has undertaken a study to determine the state of water research in South Africa. The investigation provides an overview of the investment for water-related research and development (R&D). The study will also provide a benchmark for future assessments.

The study reports on the following pertinent indicators:

- Research and development expenditures for water
- Bibliometrics of water research in South Africa as seen in the international context
- Patent analysis of water inventions
- Human resources for water research

What is being spent on water research in South Africa?

Water-related R&D spend amounted to R240-million in 2014, up from about R50-million in 2000. Despite this progressive increase in expenditure, the total amount translates into a minute percentage of gross domestic product (GDP), only 0.0069%.

Established in 1971 to, among others, promote the coordination, cooperation and communication in the area of water R&D, the WRC remains the main funder of water-related research in South Africa. In 2014, the WRC was funding 65% of all water-related research, followed by the CSIR (16%), Mintek (9%) and the National Research Foundation (8%).

Water patent analysis

Patents play an increasingly important role in innovation and economic performance as they are useful indicators

of inventive activity and a country's capacity for innovation. There is an increasing trend among policy-makers, researchers, innovation analysts and technocrats to rely on patent statistics for this reason.

The patents most often utilised internationally for this type of analyses are those granted by the US Patent and Trademark Office (USPTO) even though most countries have their own patent authorities.

The last two years exhibit an increase in the number of patents awarded to South Africans, and it appears that the long-term decline in the South African share has been stabilised. A definite highlight is the granting of 160 patents to South African inventors in 2013 – an all-time high.

In general, however, South Africa gets very few patents in the USPTO compared to, for example, companies such as IBM, which are granted more than 3 000 patents a year. Of all the patents granted to South African inventors between 2000 and 2014, only 46 patents were related to water. This translates to around three patents a year.

Human resources in water R&D

An important set of indicators monitoring the science, technology and innovation space are those classified under human resources in science and technology. Attracting, developing and retaining talent in science and technology is a priority of the water science community.

Capacity building in science is critical to meet the demand for scientific advance, and to improve science-based decision-making and problem-solving. In South Africa, transforming the water science sphere to include more individuals from historically disadvantaged communities is another focus area.

One way of assessing capacity building in the water research sector is by considering the production of Masters and PhD degrees by the higher education system. These indicators provide information about the supply of researchers, in particular scientific disciplines and specialities, and the academic institutions producing these researchers and specialities.

With this information important gaps in a research field can be identified; research can be stimulated in neglected areas; networking and collaboration between researchers can be encouraged; while facilitating informed decision-making and strategic management.

The study indicates that between 2000 and 2014, the number of relevant PhDs awarded annually in the water science sector ranged from 14 to 32. The number of water-related PhDs produced in South Africa thus remains small, and indicates an apparent lack of focus on water research in South Africa. Researchers and PhD candidates are distributed across the country.

Bibliometric analysis

Publishing one's work in a scientific journal is an integral part of being a scientist. Journal articles act as a permanent record of what has been discovered, when and by whom. It shows the quality of the scientist's work – through the peer review system other experts have rated it as valid, significant and original.

Since communication in science is realised through publications, they are considered an extremely suitable source of data to investigate the growth rates of science. Bibliometric analysis, the quantitative study of the research system, is based mainly on publication indicators.

According to the WRC study, South African researchers have been producing around 60 water-related publications per year since 1981. During the 2000s this number increased to around 100 publications per year. By 2014, the number jumped to 200 publications.

While a number of factors have contributed to this growth, increases in research funding and emphasis on publishing by funding institutions, such as the WRC, were undoubtedly of critical importance.

It is significant to note that South Africa ranks 19th in the world in the field of water research (the only African country among the top 20). This compares to the country's world ranking of 33rd in the world for the total number of publications in all fields.

It is the expressed hope that the outcomes of this study will go a long way towards guiding research and innovation policy in South Africa.

To obtain a copy of the publication, *The state of water research in South Africa 2015* (**Report No. SP 92/15**) contact Publications at Tel: (012) 330-0340; Email: orders@wrc.org.za; or download a copy at www.wrc.org.za

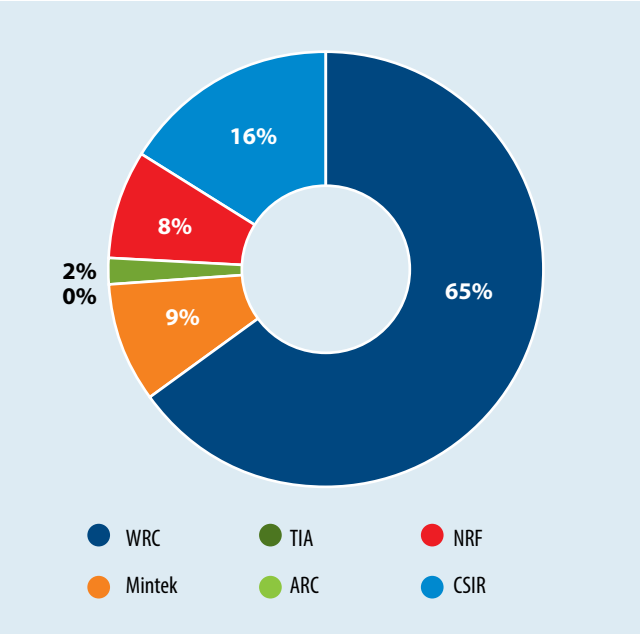

Figure 1: Funders of water research (2014).