

CAPACITY BUILDING

Towards a transformed sector – Tracking South Africa’s water doctorates

A first-of-a-kind study, commissioned by the Water Research Commission (WRC), sheds light on the career path of PhD graduates in the water sector. Article by Petro Kotzè.



In the academic field, the highest degree attainable from a university is the coveted Doctor of Philosophy or, a PhD. The degree entails the generation of original research. “It’s a proxy or indicator that you can measure as our capacity for knowledge generation,” says WRC research manager for water governance, John Dini. The qualification is regarded as essential in a knowledge-based and complex economy.

Dini managed a WRC-funded tracer study of local water and sanitation-related PhDs. Tracer studies typically aim to find and

make contact with PhD graduates for an understanding of their career paths. Relatively common the world over, it’s the first to zone in on the water and sanitation sector in South Africa and internationally.

The WRC has a long history of supporting doctorate candidates. The inclusion of masters and doctorate students in research projects are often required of funded studies. There are multiple reasons why we invest in PhDs, says the WRC’s Shanna Nienaber, Programme Manager for South Africa’s Water Research,

Development, and Innovation (RDI) Roadmap. At its simplest level doctorates are a way of indicating high-end skills in the water sector, and there is assumption that you need this to grow the research and innovation potential, she explains.

The WRC, like many other funders in the research sector, tracks and reports on the students that it supports annually. However, there is not a formal tracking system for these students once they are no longer attached to a project or contract. Over and above that, the WRC is one of a handful of funders of doctorate studies, resulting in the information that is available being scattered.

“We’ve known for a long time anecdotally that PhDs add value to the system, but we’ve never put that into a formalised methodology,” says Nienaber. As a result, though it is known how many PhDs are produced in South Africa annually, it’s not that clear what the impact of the qualification is on the graduates’ career path afterwards or, by default, the sector that they work in.

Information like this is valuable for numerous reasons.

Why track PhDs?

Tracer studies give valuable insights to many sectors beyond academia. Results give an indication of trends in employment opportunities and salaries for doctorate holders, and can be used to evaluate the effectiveness of equal opportunity efforts. It can show funders what the impact of their grants are and where their funds should be allocated in future. The studies can show in which sectors research capacity and, assumedly, innovation is growing, and in which sectors it’s lacking. This is important for policy makers.

One example in South Africa is our Water RDI for 2015 – 2025. The document is a framework for RDI necessary to implement national policy, strategy and planning for the country’s water resources. The Roadmap was developed by the Department of Science and Innovation in partnership with the WRC and Department of Water and Sanitation and lays out a vision of a South Africa that is a leader among middle income countries in the development and deployment of water management practices and technologies. One key to achieving this vision is increasing the number of relevant PhDs produced, to an average of just over 200 PhDs annually, increasing to over 500 in 2025/26.

Tracer studies can measure if goals like these are on track.

Common in European countries, the United States, China and Australia, to name a few, only very limited tracer studies of doctorate graduates have been done here.

“It is of critical importance to South Africa to start monitoring the performance of the PhDs,” says the University of Pretoria’s Prof Anastassios Pouris, Director of the Institute of Technological Innovation. Pouris initiated the study, and was the project leader.

The study can be seen as a first step in that direction, says Dini. The objectives were to find out if the work experience of water-related PhDs could be traced; if too many or too few water-related PhDs were trained; how mobile doctorate-holders

are between sectors; when they leave research for a career in management; and, if water-related PhDs remain in the country.

Finding the answers was not a clear-cut process.

On the hunt for water-related PhDs

Water research is a multi-disciplinary field that covers an array of disciplines. Since there is no one specific field of study dedicated to water and sanitation, and there is no system keeping track of this specific area of specialisation, the researchers had to think outside the proverbial box to first identify the right PhDs and then, to find the graduates.

Pouris explains that information on higher education is collected by the Department of Higher Education. The number of PhDs that graduate is monitored, but the information is not classified into specific disciplines. We know, for example, that we produce fewer PhDs in engineering than in social sciences, but we don’t know what is happening in sub-specialties within these fields, he says.

“As a result, it is difficult to identify PhDs related to water.”

The project team turned to the National Research Foundation’s open source Nexus database. The database contains information on approximately 150 000 South African research projects, including current and completed theses and dissertations on all fields of science since 1919. Information includes the project titles and abstracts in English.

We collected all the PhDs over the five-year period from 2013 to 2017, explains Pouris. This produced 12 500 theses. Then, to identify those relevant to water, says Pouris, they searched the titles for a list of relevant keywords. These included terms like arid, aquifer, borehole, riparian, sanitation and sludge, to name a few. Now, they were left with 300 theses. From this selection, the abstracts were checked for accuracy. A thesis was excluded if its topic, although including one or more of the relevant terms, could not inform any of the issues mentioned in the Water RDI Roadmap. The team was left with 112 relevant doctorates.

“There is an element of subjectivity to the selection process,” says Dini. Yet, the exercise was deemed a good starting point for such processes in future.

To find the graduates, the websites of relevant universities and databases indexing academic articles were investigated. Unexpected help also came from social media. “We could find information about the graduates on social media that we couldn’t find from individuals,” says Pouris. This included data such as job progression and how quickly they were employed.

Dini says the use of social media, in particular, was interesting. The study showed that it’s a massive source of information to be harvested for studies of this kind. Even if contact details were not found, social media still allowed researchers to find at least some information on almost all identified graduates.

From the 112 identified relevant theses, contact details were obtained for 100 doctorate graduates. Five candidates were

not traceable and for seven, no contact details could be found, though limited information about employment and places of residence were traceable. Questionnaires were sent out to 100 doctorate graduates, of which 48 were completed and returned.

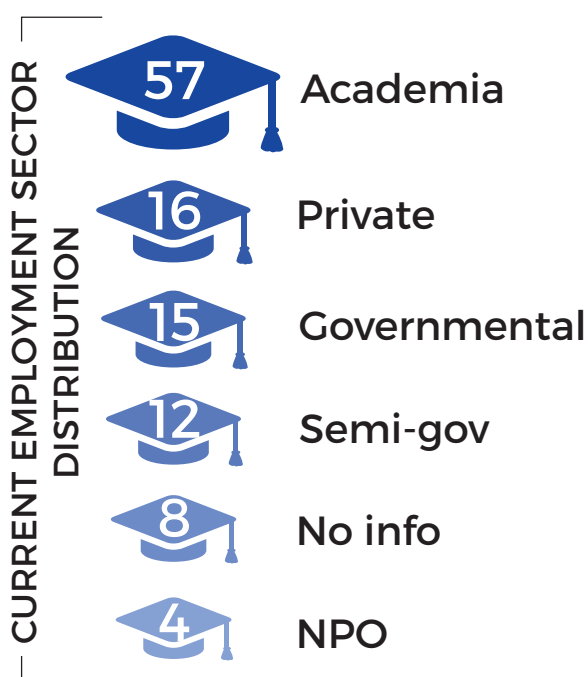
The questionnaire was divided into six different modules dealing with different aspects of issues of interest. These were doctoral education, early career research positions, employment situation, international mobility, career-related experience and personal characteristics.

What are South Africa's water-related PhD graduates up to?

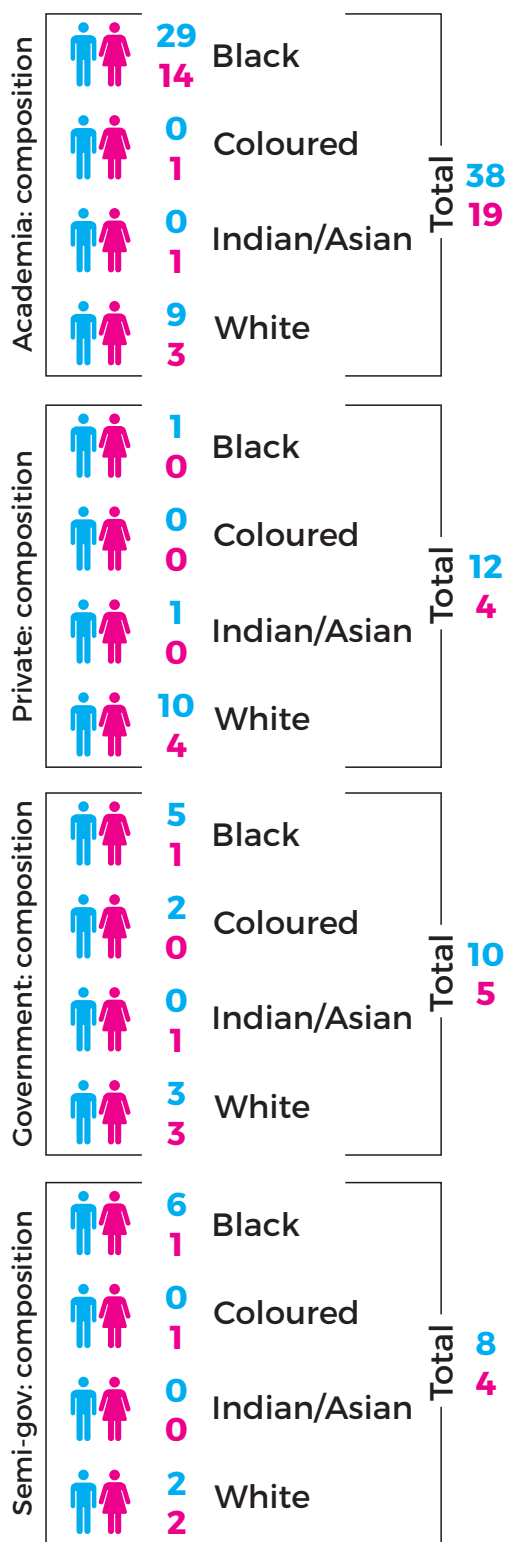
According to the project report, the main findings were as follows:

- All PhD-holders were engaged in jobs. Employment profiles were traceable for 104 graduates, all of who were found to be employed.
- More than 50% of the PhD-holders occupied positions in the university sector. Of those in the university sector roughly 23% held post-doctoral positions.
- Approximately 30% of the PhD-holders were in other African countries having gone back to their country of origin.
- Approximately 90% of the respondents were in occupations related to the water and sanitation sector.
- Mobility between sectors was identified to be 16%. Eighteen out of 112 graduates identified to have transitioned between sectors.
- The work experience of 40.1% of the PhD holders was identified to be between two to five years.
- Twenty PhDs (18%) declared that they had management experience.

The study also found the number of male graduates to be almost double (63.4%) compared to the female graduates (32.1%).



They also looked at gender and race within employment categories (see figure below).



The semi-government category consisted of science councils and research institutes affiliated to the government whereas NPOs included not for profit organisations that did not have governmental stake holding. A 2:1 gender ratio exists across all main categories. Within the NPO category an equal gender distribution was noted with two males and two females. The racial distribution consisted of two white males and one black female and one white male. The NPO category is not represented graphically because of the small size of the category.

Digging deeper into the details

While the study wasn't able to say whether supply meets demand, it was able to infer that supply is currently not exceeding demand, notes Dini.

For Pouris, this is one of the key findings, especially for a country like South Africa with high unemployment: people with PhDs in a water-related subject find jobs. Pointing out the low unemployment rate indicated in the result, Pouris says that "in this country, having a group in which so few are unemployed is really extraordinary."

Dini says he also found the results on demographics useful, and thought the spread in terms of race and gender better than he expected, though there is still much work to be done regarding gender balance in particular.

Furthermore, Pouris points out that 90% of respondents remain in the field of water. While one of the advantages of a PhD is that a graduate can easily adapt to different disciplines, the finding that graduates remain in the water sector must mean that there is a high demand for these graduates.

An area of concern that has been highlighted by the findings is the number of water-related PhDs leaving the country. "If 30% of graduates leave to return to their country of origin, this means that the South African water sector has access to a significantly lower number of individuals than graduate from its universities," says Dini. From a policy perspective, this has implications for the investments made towards PhDs, and the current attempts to retain those skills gained as a result, he says.

Furthermore, says Pouris, "there are a number of indicators that are pointing to the fact that we need more PhDs on water." The first is to be found in South Africa's National Development Plan (NDP), which calls for a vast increase in South African doctoral graduates – to over 5 000 per year by 2030 against the figure of 1 420 achieved in 2010. "Water is part of the bigger issue," he says. "We need to increase the number of water PhDs as part of attempts to reach the NDP objectives."

Second, Pouris points to the goals of the RDI roadmap. The number of water-related graduates identified in the study concludes that about 15 to 30 are produced each year – far short of the 200 PhDs called for in the roadmap. However, Nienaber sees the results in a different light. The roadmap's targets are based on an assumption of what a research system that produces optimal research outputs looks like, and how many PhDs need to be produced over time to achieve that. The targets were aspirational, and set intentionally high, she says. The idea was to inspire a sector to strive to a big goal, in order to stimulate activity within a system. Though it's the most broadly consulted document we have, she adds, it's not uncontested.

The study's final report also points out that the numbers are much better in comparison to what can be expected from current research and development (R&D) funding in the country. Water R&D expenditures constitute just below 1% of the country's total expenditure. If the expected number of doctorates was 1% of the 1 263 that graduated in all disciplines

during 2015, the actual number is almost three times that. "As such, it's clear that the human resources produced, related to water, are more than what was expected from the relevant inputs".

Still, Nienaber points out that the bigger understanding from the study comes from what happens to the graduates, and not how many they are. "The biggest take home for me is that there is sense in funding PhDs. People that go this path will at least spend a significant time in this sector."

The way forward

The study should be seen as a first step in the way forward, says Dini. From this starting point, adds Nienaber, there are areas to be debated. These include, as a first, which database should be used to identify the doctorates. A scaling up of the methodology is necessary. Then, she says, social media as a data source is an area that is set to grow, and we need to look at how to use it optimally. Another area of debate is how long the graduates need to be tracked for meaningful information.

The study has set the building blocks in that direction in South Africa and, says Dini, confirms the beauty of the reference group model that the WRC uses for its research projects. This allows for broad and cross-sectoral consultation of project methodologies and study results. The reference group for this study included representatives of the Department of Higher Education and Training, the Department of Science and Innovation (DSI), the NRF and select universities.

"The bigger question was whether what we are seeing is unique to the water sector, or representative of what's happening across the board and sectors for all PhD's," says Dini. Another question was if we are doing something right in the water sector that others can learn from, he says.

Steps to answer these questions are now being taken. The DSI has provided funding to the University of Stellenbosch, via the WRC, for another, broader tracer study. This project will aim to trace every PhD graduate across all disciplines from South African universities from 2000 to 2018. Already, over 30 000 PhDs have been identified as part of the 18-month project. From the first exploratory steps that have been put in place, this will make even larger strides towards filling a significant gap in South Africa's push to increase doctoral graduates in the country.

To download the report, Trace study of water PhDs in South Africa (WRC Report no. 2851/1/20), visit: www.shorturl.at/szBWO