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The profile of postdoctoral research fellows in South Africa: Trends over the past two decades

The need for evidence on postdoctoral research fellows, or ‘postdocs’, has become increasingly evident globally, as many countries, including South Africa, lack information on these researchers. We used existing sources of quantitative data to provide a longitudinal profile of postdocs at South African public universities. These sources include national research-and-development surveys and data from the national Higher Education Management Information System. Our focus was on postdocs’ representation and research intensity (i.e. time spent on research) within the national research system, as well as on two key demographic features, namely nationality and gender. We draw comparisons with findings reported for other countries to situate our results within the global science system. Interpretation of our results leads us to comment on global and national developments and policies relevant to postdocs.

Significance:

- This article provides, for the first time, longitudinal, quantitative evidence at the national level about postdocs in South Africa, a category of early-career researcher which has been growing in size and relevance but has remained largely invisible.
- The findings provide the basis for a critical reflection on current discourses and policies related to postdocs in South Africa.
- Interpretation of the findings allows us to identify priorities for future research on postdocs in South Africa that would be most useful to inform both national and institutional policy.

Introduction

In the winter of 2022, one South African university placed an advertisement for 200 new postdoctoral research fellows, or ‘postdocs’. According to the same university’s vice-chancellor, this would bring the number of postdocs at the institution to 650. To put this into perspective, in 2020, the same university employed 707 permanent academic staff with a doctoral degree, the equivalent qualification held by *all* postdocs. The advertisement refers to the university’s rise in the global rankings and emphasises the research productivity of postdocs. The productivity requirement for postdocs at the university is contractual – postdocs are expected to “do research and to publish such research in accredited journals or conference proceedings. The norm is the publication of two accredited research units.”

This example illustrates two global discourses concerning postdocs. According to the pipeline discourse, postdocs are important for sustaining the academic profession^{1,2}, that is, in reproducing academic labour³. In the human-capital discourse, postdocs are valued as highly skilled labour⁴⁻⁶ for bolstering research and innovation. However, while the pipeline and capital discourses augur a productive future for the postdoc, many postdocs seem to face a professional cul-de-sac and the harsh realisation that a career in academia is unlikely.^{1,7}

Another discourse relevant to postdocs is that of “science as a global market of competing world-class universities”⁸. The introduction of postdoctoral programmes by South African universities was, in part, underpinned by national priorities geared toward developing the nation’s knowledge capital as globally competitive.⁶ Therefore, the emergence of postdocs is, to some extent at least, indicative of the competitive behaviour of South African universities. Institutional policies emphasise the number of research publications produced by postdocs.⁹ This emphasis is unsurprising in the South African context given that universities compete with each other for significant financial subsidies from the national government based on the number of publications produced in a given year. Combined with the fact that many postdocs are externally funded, postdocs are efficient income generators for South African universities.

At a more systemic level, national policy documents refer to the postdoc role as providing doctoral graduates with further experience in research and innovation¹⁰, especially as academics in the university sector¹¹. Postdocs are also seen as playing a crucial part in ‘augmenting’ doctoral supervisory capacity at universities.¹²⁻¹⁴ This capacity is required to alleviate a supervisory ‘bottleneck’ created by the greater increase, from 1996 to 2014, in the number of doctoral enrolments (350%) compared with staff with a doctoral qualification (65%). South African universities face a conundrum: they need more academics with doctoral qualifications, and to do so, they need to produce more doctoral graduates. But for that, they need more staff with doctoral qualifications to supervise doctoral students.¹⁵

Postdocs partly solve this conundrum and are therefore considered functional for the South African university sector¹⁶, but the postdoctoral fellowship as a social system may also be dysfunctional for postdocs. Concerns have been raised by the Organisation for Economic Co-operation and Development (OECD) about postdocs as part of the “research precariat [...] who work in positions with little job security, poor compensation and an unclear path to a permanent post”¹⁷. In a recent national tracer survey of more than 6000 respondents who obtained a doctoral degree from a South African university during 2000–2018, nearly 30% had accepted a postdoctoral fellowship on completion of their studies because “other employment was not available”¹⁸. Recently, this percentage has increased, which suggests that the absorptive capacity of the South African science system to employ doctoral graduates and postdoctoral fellows has already reached a point of saturation¹⁸ (also see Simmonds and Bitzer¹¹).

Universities South Africa, in its 2013 national postdoc policy, was attuned to precarity and the risk of postdoc ‘serialisation’. The organisation included a statement limiting the period of a postdoc fellowship to a maximum period of 5 years.¹⁹ Whether universities adhere to this policy prescription is unknown; nor does it resolve the matter of postdocs facing an academic dead-end at the end of the 5-year period. An oversupply of postdocs relative to available faculty positions has led to calls for improved assessment of career outcomes.²⁰⁻²²

Considering the background provided above, it seems surprising that there has not yet been any large-scale, quantitative investigation of postdocs in South Africa. In its policy paper on reducing the precarity of academic research careers, the OECD identifies the need for more evidence on postdocs, noting that countries often do not have a good understanding of even the number of such researchers.²³ This lack of data about postdocs “has made it difficult to develop policies to address concerns about salaries, working conditions, diversity and career development, and to evaluate the impact of existing policies”²⁴ (also see Bankston and McDowell²⁵).

Even though we lack generalisable data on South African postdocs that would allow us to answer questions on the effects of employment precarity on postdocs, some existing data are available and – when analysed in combination – provide an insightful profile of postdoctoral research fellows in South Africa over the past two decades. This is the focus of this article.

In South Africa, annual, national surveys of research and development (from here on referred to as the R&D surveys) are used to collect data on postdocs in the country’s science system (including universities). However, until now, these figures have been reported without any further analysis and/or interpretation. We analysed this data source, in combination with data from the national Higher Education Management Information System (HEMIS), to sketch a national profile of postdocs, and how it has changed over the past two decades.

We calculated and examined postdocs’ representation and research intensity (i.e. time spent on research) within the higher education sector, with a further focus on two demographic features: nationality and gender. Nationality is a key variable, given that postdoc cohorts typically comprise large numbers of international fellows, while in South Africa national policy has recently placed restrictions on the number of non-South-African postdocs that can be funded by the public purse²⁶, and there is a growing concern about xenophobia in South African universities²⁷. Gender is included in our analysis because the postdoc has been described as “a critical time for women, when personal life transitions and professional ambitions collide”²⁸. Thus, it may be a stage during which women begin ‘leaking’ from the academic ‘pipeline’ at an increasing rate, as research elsewhere^{24,29,30} has shown. Finally, we compared, where such data exist, South African postdocs with those

elsewhere, as the first step towards addressing the lack of evidence required as a basis for designing policy geared towards the management and professionalisation of postdocs in South Africa.

Methodology

The main sources of data for our secondary analysis were the statistical reports covering the fiscal years 2007/2008 to 2019/2020 produced by the Human Sciences Research Council’s Centre for Science, Technology and Innovation Indicators, on the basis of the annual R&D surveys. In the reports, figures are also available for the preceding 4 years, which required consulting only the 2011/2012, 2016/2017 and 2019/2020 reports for figures pertaining to the period 2007–2019.³¹⁻³³ We also included data on postdocs found in one of the earliest R&D survey reports (for 2003).³⁴ All these reports are freely available online.

The R&D surveys collect data on all public universities, using a census approach, although in the past few years, between five and seven of the universities did not respond. The reference period is the year prior to the survey (the first year of the two years in a report’s title). The reports provide the following data for postdocs: headcounts, full-time equivalents as a percentage of headcounts (an indicator of time spent on research, or research intensity), nationality (South African versus non-South African), and gender.³¹⁻³³ Where relevant, data from the Department of Higher Education and Training (DHET)’s Higher Education Management Information System (HEMIS)³⁵ were also drawn upon.

Regarding comparative global figures for the past two decades, the largest recent survey of postdocs is the 2020 *Nature* survey, which collected data for a total of 7670 respondents, representing 93 countries. The anonymised data³⁶ have been deposited in an open access repository (see go.nature.com/3tmckuq). Only 54 of the respondents lived in South Africa at the time of the survey; we deleted these data from the data set, together with those of the 381 respondents who were not employed in the university sector, to increase comparability with the R&D survey data. We analysed the remaining data ($n = 7235$) to provide a benchmark with which to compare the South African figures. Other benchmarks took the form of results from national surveys of postdocs conducted in other countries, which are referenced in the ‘Results’ section. Given that we analysed existing data, ethical approval does not apply.

Results

The first record of the number of postdocs in South Africa suggests that in 1999 there were approximately 300 postdocs.³⁷ One of the earliest R&D surveys found that number to be 357 in 2003.³⁴ Since then, the number of postdocs has increased to 2867 in 2019. The steepest growth rate (close to 200%) is observed for the first half of the period (2007–2013), and as Figure 1 shows, the growth has decelerated since 2017.



Figure 1: Number of postdocs at South African higher education institutions in 1999, 2003 and from 2007 to 2019, indicating decelerated growth since 2017, as well as the rate of increase from 2010 to 2019.

Comparative figures are rare, but those available suggest that South Africa's trend is aligned with those reported for at least two other countries. For example, from 2010 to 2019, the rate of increase of 143% (or 1180 to 2867) measured for South Africa is similar to the 144% increase recorded for Finland²³, and the 142% (from 10 559 to 25 514) for China over the same period³⁸.

Nationally, relational measures are useful to contextualise the increase in postdocs in South Africa. The first of such measures is provided by the R&D surveys in the form of researchers in the university sector with a doctoral degree or equivalent. Table 1 shows that, in 2007, postdocs constituted only 11% of such researchers. Six years later, this proportion almost doubled (to 21%), but has decreased slightly since then, to 18% in 2019.

From 2011 to 2019, the percentage of academic staff who hold a doctoral degree also increased quite dramatically, from 36% to 48%.³⁹ If this had not been the case, it is likely that the percentage of postdocs relative to doctoral-qualified academic staff may have at least remained stable or increased further.

A second national relational measure is the number of lecturers in South African public universities. We combined the R&D survey data with data from HEMIS on the number of permanent academic staff who hold the position lecturer (at all levels, i.e. junior lecturer, lecturer and senior lecturer), as this is the level at which one may assume postdocs, depending on their level of experience, would enter academe. We found that the number of those staff grew at only 37% from 2007 to 2019, compared with the almost ten times greater rate of growth (366%) in postdocs over the same period (Figure 2).

Postdocs do not only contribute to the human-resource base in absolute or relative numbers, but also in terms of their research intensity, i.e. the time they spend on research. The R&D surveys measure time spent on research in terms of research full-time equivalents or 'person years of effort' allocated to research, which are expressed as a percentage of headcounts. According to our analysis of these data, postdocs dedicate on average 92% of their time performing research (for the period 2007–2019). This is more than the 55% for doctoral students and almost four times the 24% reported for researchers (irrespective of highest qualification, as full-time equivalents are not disaggregated by that variable). As Figure 3 shows, these percentages fluctuate

noticeably for postdocs prior to 2012, but they have remained relatively stable since then and have not deviated by more than 2–4% from the averages for all three subgroups.

Next, we analysed South African postdocs according to two key demographic features. The R&D surveys disaggregate the headcounts of postdocs by nationality, but only from 2011 to 2016. On average over that period, 62% of the postdocs in South Africa's universities were not South African citizens. The percentage increased (by 13 points) from 54% in 2011 to 67% in 2014 but decreased again thereafter (Figure 4). The most recent available figure from the R&D surveys (2016) matches the 61% of respondents in the *Nature* survey who reported that they were not (in 2020) undertaking a postdoctoral fellowship in their native country.

Earlier research that involved, inter alia, the collection of data from the South African National Research Foundation (NRF) and from 13 universities, found that, from 2005 to 2010, women constituted 40% of postdocs in South Africa⁴⁰, while our analysis of the R&D surveys produced a slightly higher average for 2007 to 2019 of 42% of postdocs. These percentages are lower than those reported by cross-national surveys. In 2019, women's representation among postdocs in South Africa was measured at 41%, which is a notable 12 points lower than the percentage of female respondents (53% of the 7151 who self-identified as either male or female) in the global *Nature* survey. A 2017 survey of 898 postdocs at European universities found a similar, "higher number of responses from women (61%) than men"⁴¹.

Figures reported by smaller, national surveys are more aligned with the South African ones. The 2013, 2016 and 2019 National Postdoctoral Association's surveys in the USA found women's representation to range between 43% and 44%.^{42,43} The Canadian Association of Postdoctoral Scholars surveys of postdocs working in Canada and Canadians working internationally found female respondents in the 2009, 2013 and 2016 waves to be 44%, 46% and 48%, respectively.³ Still, the percentage of South African women postdocs is consistently lower than those reported elsewhere.

To understand the extent of women's minority among postdocs in South Africa, a relational measure is again useful, this time taking into account career stage. Using HEMIS data³⁵, we determined that, from 2007 to 2019, women represented on average 43% of doctoral graduates

Table 1: Number of PhD-qualified researchers and postdocs in the higher education sector, 2007–2019. PhD-qualified researchers include permanent and contract (6 months or longer) positions, as well as emeritus professors and honorary fellows.

Year	PhD-qualified researchers	Postdocs	
	N	N	%
2007	5784	615	11%
2008	6392	627	10%
2009	7141	781	11%
2010	6578	961	15%
2011	7188	1180	16%
2012	7974	1384	17%
2013	9257	1801	19%
2014	9739	1983	20%
2015	10 638	2268	21%
2016	12099	2471	20%
2017	14 467	2741	19%
2018	14 735	2727	19%
2019	15 705	2867	18%

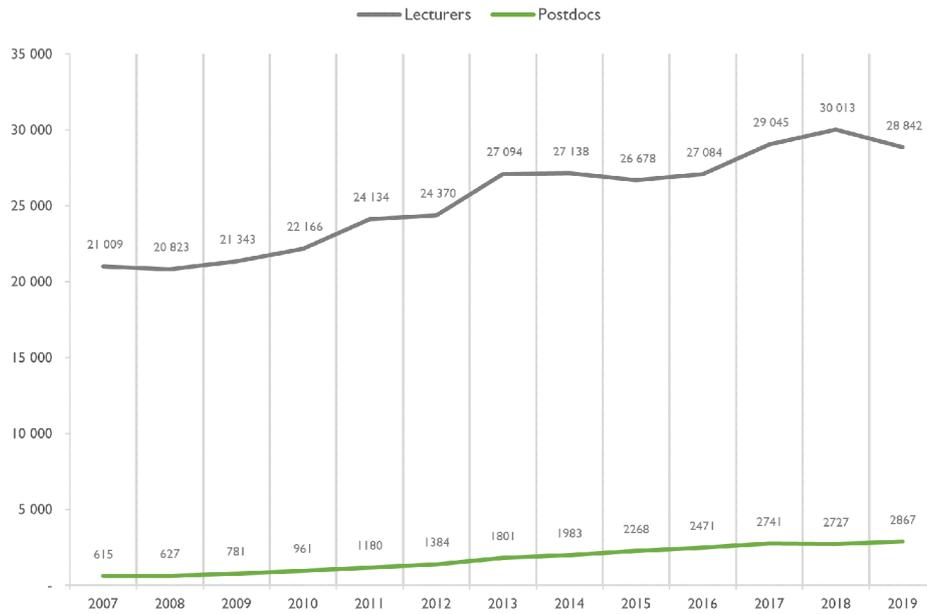


Figure 2: Number of postdocs compared to that of lecturers (junior lecturers, lecturers, and senior lecturers) at South African public universities, 2007–2019.

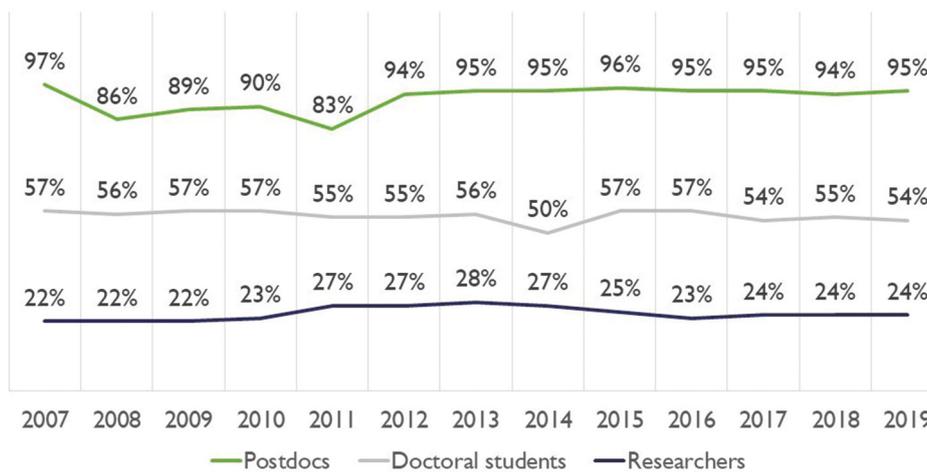


Figure 3: Research full-time equivalents as percentages of headcounts (a measure of time spent on research) for doctoral students, postdocs, and researchers in the university sector, 2007–2019.

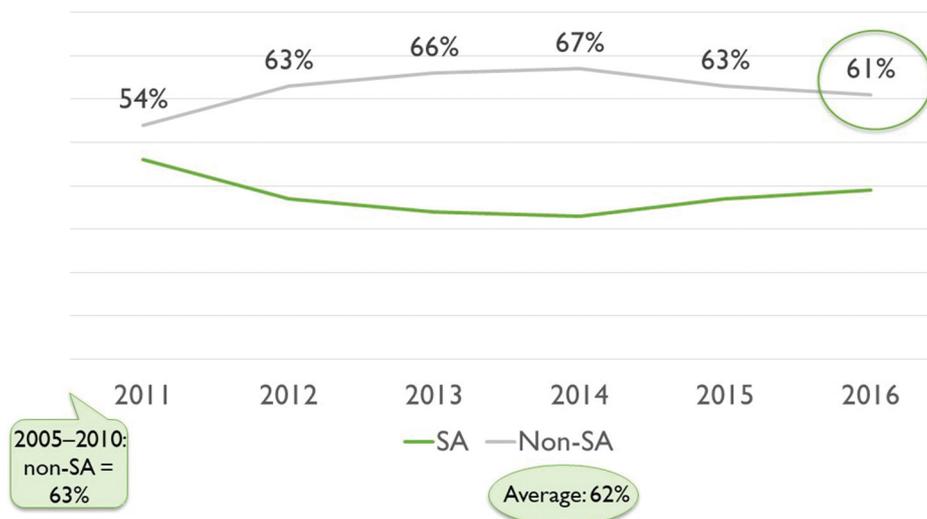


Figure 4: Percentage of postdoctoral fellows who are South African (SA) and non-SA nationals, 2011–2016.

from South African universities. The R&D survey data indicate that, among researchers at universities with a doctoral qualification, women constituted only 39%, on average, over the same period. Figure 5 shows that the percentages of women in the three career stages have begun to converge, especially since 2013.

Figure 5 further shows that in South Africa there has been no clear trend towards either an increase or decrease in the percentage of female postdocs from 2007 to 2019. Our results do not align with a steady growth in female representation among postdocs reported in Canada³ and the USA⁴⁴ over similar periods.

Discussion and conclusion

Our longitudinal analysis shows a significant growth in the number of postdocs at universities in South Africa, both in absolute numbers and relative to the growth of doctoral-qualified researchers and permanently employed lecturers in the university sector. Since 2010, the growth has been comparable with that observed for at least two other countries for which data are available. We also show that postdocs are highly research intensive, as they dedicate much more of their time to research than do permanent academic staff and even doctoral students. Among the latter, 60% study while they are employed¹⁸, while enrolment in degree programmes with a tuition component also reduces time spent on research. South African policy statements¹²⁻¹⁴ and recent research^{1,11} indicate that postdocs in the country are increasingly required to assist academics with other academic duties, in particular, doctoral supervision, but our results show that this has not (yet) impacted negatively on the high percentage of postdocs' time spent on research. Postdocs, therefore, can be expected to be a major contributor to the research output of their host universities, although the extent of their contribution is yet to be determined and should be a focus of future research.

In relation to the dominant discourses in higher education referred to in the introduction to this article, the findings support the notion of ascendancy of one particular global discourse (of four) proposed by Marginson⁸, that is, of science as a global market of competing universities. Research, particularly the number of peer-reviewed publications produced, is a major indicator in the calculation of universities' scores in global rankings, and one of the primary drivers of the global reputations of both researchers and their host universities.⁴⁵ From a local perspective, South Africa's system of rewarding universities financially for publications means that the country's 26 public universities also compete nationally for finite government funding ringfenced for research-output-based subsidy allocations.⁴⁶ It is therefore likely that universities, in response, are appointing increasing numbers of postdocs at relatively low labour cost to sustain or increase a competitive advantage.

From a broader and theoretical perspective, this institutional response can be understood with reference to academic capitalism⁴⁷ and resource dependence theory⁴⁸. The former describes a shift to enterprise modes of academic production (attributable to the spread of global capitalism), including the rise of competition regimes in the distribution of public funds for research. At the same time, because of changing priorities in government funding, universities in South Africa are becoming increasingly dependent on external sources of funding (i.e. so-called 'third-stream' funding)⁴⁹ to support their research activities. According to resource-dependence theory, this situation fosters organisational strategies that, for example, stimulate demand for postdocs as highly qualified labour over which universities have leverage (instead of creating positions for permanent academic staff protected by labour-friendly legislation), and which do not represent long-term commitments by universities. These developments have coincided with global and national increases in doctoral graduates, and an inadequate labour market demand for their skills, thereby providing a surplus supply of labour, in the form of postdocs.⁵⁰

If postdocs provide the economically optimal research workers for universities in this context, they will be recruited, without regard for the number of career positions available.⁵⁰ In this way, the human-capital discourse is overridden by the imperatives of academic capitalism, as reflected by our finding that the growth in postdocs is almost ten times higher than the growth in staff in permanent positions available to postdocs. In such a context, one also observes a form of credential inflation¹: the greater the mismatch between the supply of doctoral graduates and the availability of permanent academic positions, the more doctoral graduates are encouraged to pursue a postdoc in order to become more competitive and improve their chances in the job market, if they are strongly committed to an academic career.²¹ Although postdocs may find career opportunities outside of universities, these are limited in South Africa for doctoral graduates¹⁸, and, for most postdocs, the goal remains to secure a permanent position in academia^{11,18}.

Our findings therefore support concerns raised^{1,9,18} about the casualisation of academic labour in the country, and further indicate that it may be gendered. Although there is variation over time in the representation of women among South African postdocs, it is within a relatively narrow range (compared to some other countries) and the variation seems to be decreasing. At the same time, the percentage of women among researchers with a doctoral qualification has increased, and there does not seem to be a 'leak' from the postdoctoral pipeline into permanent positions. Male and female doctoral graduates from South African universities have also been found to be equally likely to accept a postdoc fellowship, suggesting that female representation is not a major issue of concern in the case of postdocs.¹⁸

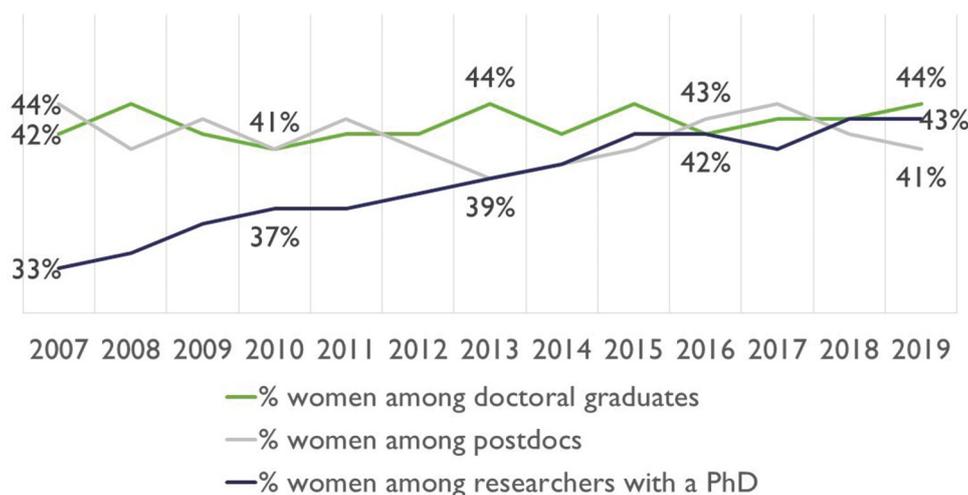


Figure 5: Percentage of women among postdocs compared to percentage of women among doctoral graduates and among researchers with a doctoral qualification (university sector only), 2007–2019.

It may be that employment policies favouring women doctoral graduates for permanent positions are reducing the percentage of women in postdoctoral fellowships. In other words, if women have a greater chance of securing scarce full-time positions than men, they may not need to increase their market value through postdoctoral training. However, further research on this issue is required, and as postdoctoral fellowships are not only precarious, but also offer various benefits to those who hold them, the percentage of female postdocs in South Africa needs to be carefully monitored.

It is important to note that an increase in postdocs is not necessarily indicative of a healthy national system of innovation. Growth in postdocs tends to be associated with economic recessions and limited growth in R&D funds⁵¹, which, in turn, make it increasingly hard for postdocs to find permanent employment⁵². Postdocs' precarious contracts could lead to a potential loss of knowledge for a national system of innovation, as they switch from one contract to another, or exit research career paths altogether.⁵³ The latter outcome amounts to an inefficient use of resources and inefficiency in the production of knowledge associated with an increase in postdocs because

as a low-cost complement to faculty and a substitute for other labour inputs there is little incentive to make full use of postdocs' capabilities or to make difficult decisions about the allocation of scarce resources.⁵⁰

There would also be fewer incentives to increase the number of permanent faculty members⁵⁴, as our findings suggest is the case in South Africa.

While the number of postdocs in the South African university system has grown over the past two decades, the findings also show a recent deceleration in the growth of postdocs. Without more data, also on choices made by doctoral graduates and the experiences of postdocs, it is difficult to pinpoint reasons for the deceleration in the growth of postdocs in South Africa. The notion of credential inflation referred to above seems to discount, as a possible reason, an increasing realisation among doctoral graduates and first-time postdocs that postdoc positions are increasingly unlikely to lead to permanent academic or other work opportunities in South Africa. We would suggest, for future research, that the focus should be on a decline in the growth in international postdocs in South Africa, as our limited data seem to suggest is the case.

In this regard, 'demand' in host countries for international postdocs⁵⁵, as reflected in various aspects of public policy that attract the foreign born to study in a country⁵⁶, has been shown to play an important role. A notable signal of a reduced demand for international postdocs is that NRF funding for such postdocs has recently been reduced. The NRF's new funding framework prescribes that universities' applications for its postdoctoral funding must be aligned with the foundation's "equity target" of "80% of South African citizens and permanent residents"⁵⁷. In 2018, before the implementation of the framework, 41% of the 799 NRF-funded postdocs were not South African citizens or permanent residents⁵⁸, and that percentage has most likely decreased since then.

The new framework has been described as a short-sighted development that does not appreciate the importance of attracting foreign talent to the country¹⁸ and is likely to stifle the contribution of international postdocs to South Africa's science system and the country's development²⁶. The contributions of foreign-born postdocs to their host countries have been detailed elsewhere⁵⁶, but Gaughan and Bozeman⁵⁹ caution that "dependence on the foreign-born" exposes a country to "the vicissitudes of highly political immigration policy debates". This observation is highly relevant to South Africa, where evidence²⁷ indicates that foreign-born researchers, especially from the rest of Africa, are facing various forms of xenophobia.

The postdoc therefore becomes a crucial site for the investigation of divergence or convergence of nationalist political priorities (including policy imperatives of local equity and inclusion), the national discourse of development (specifically, universities' role in development⁵²),

and universities' institutional policies that promote the recruitment of postdocs within the discourse of science as a global market of competing universities. To do so constructively, the notion and expectation that postdocs contribute, via their research, to economic development needs to be interrogated critically.

In this article we have illustrated how relatively standard R&D survey data may be put to use to provide an evidence-based overview of postdocs in a country, especially if it is interpreted within the local policy context and compared with global trends. However, as is usually the case with the secondary analysis of existing data, our analyses remain limited in many respects. Further research is required to better understand postdocs' contribution to the national science system and to their host universities' research output, as well as their experiences as a relatively new type of knowledge worker that has become institutionalised in the South African university workforce.

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Competing interests

We have no competing interests to declare.

Authors' contributions

H.P.: Conceptualisation; methodology; data collection; analysis; writing – the initial draft; writing – revisions. F.v.S.: Data collection; analysis; writing – revisions.

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