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Brain circuity: The case of South Africa as a hub for doctoral education

The production *and reproduction* of knowledge are important components of national development. As student mobility increases, globally and within Africa, so does the national diversity of students as they seek to further their postgraduate studies at the limited number of research universities in Africa. Knowledge migration is inevitably a relationship between nation states because migration is driven by push factors (such as the socio-economic conditions and opportunities) in the country of origin as well as by pull factors (such as the rules and incentives for entry, participation in postgraduate education and post-study residency), which are prerogatives of the host nation. In other words, migration and development must be understood in comparative terms. The brain drain perspective on migration and development takes mainly the perspective of the origin country into consideration. Migration and the loss of high-level skills are seen as detrimental to the development prospects of the country of origin. The brain circulation perspective moves the discussion forward by suggesting that there are residual returns to the country of origin. However, relatively little attention has been given to the impact of knowledge migrants on the host nation when the host is facing its own post-colonial development challenges. This is the dilemma facing South Africa as a hub for doctoral students from the rest of Africa: attracting top doctoral students from the rest of the continent to contribute to the country's knowledge capacity but at the expense of developing local talent, thereby setting up a complex tension between underdevelopment and development. Here we establish whether South Africa is maintaining its position as a PhD hub on the African continent and explore the extent to which the brain circulation argument holds up in the African context. We suggest that, given the current policy environment in South Africa, brain circuity is a more likely outcome, where brain circuity describes the flow of knowledge characterised by indirection and undesirable intricacy.

Significance:

- In the case of South Africa as a destination for doctoral students from the rest of Africa, neither the brain drain nor the brain circulation theories of student mobility hold; rather, students are confronted with an overly complex set of conditions resulting in brain circuity.
- Despite the continued attractiveness of South Africa as a destination for doctoral students, the tension between equity and development remains unresolved at the policy level, potentially undermining the circulation of knowledge for the benefit of all African countries.

Introduction

In both developed and developing countries, the importance of doctoral education has been growing.[1-3] This rise in importance can be attributed in part to the need for the academy to reproduce itself for its own survival. Doctoral graduates seed the academy. In addition to the survival of the academy, and more pertinent from a broader policy perspective, doctorates are seen to play an important developmental role. By ensuring the continued production and transfer of new knowledge, doctoral graduates contribute to socio-economic development. In sum, doctorates hold the key to both the reproduction and production of knowledge, which are important contributors to national development.[4]

The importance ascribed to doctoral studies needs to be viewed against the backdrop of at least two interlinked developments in higher education: diversity and mobility. Recent developments across the globe have reignited calls for more diverse institutions, including universities. At the same time, the mobility of students between countries, in part to support diversity aspirations, has been made possible by national and institutional policies, funding and incentives, as well as the ease of accessing information about study opportunities and of movement.

Both the mobility and diversity of university student populations most often fall under the rubric of the internationalisation of higher education.[5,6] For obvious reasons, prior to 1994, but also in early democratic South Africa, the internationalisation of universities in South Africa did not feature prominently in higher education policy.[7] As attention turned towards globalisation in post-apartheid South Africa, the internationalisation of postgraduate enrolments began to appear in various policy documents.[8] The National Plan for Higher Education[9], for instance, recommended that institutions increase recruitment of students from the Southern African Development Community (SADC), especially at the postgraduate level. South Africa's National Development Plan[10] envisaged South Africa as being capable of attracting a significant share of the international student population. And the most recent White Paper for Post-School Education and Training[11] noted that hosting large numbers of international students, especially SADC students, represents a major contribution by South Africa to the development of the sub-continent.

The South African National Development Plan[10] made several bold proposals, including for South African universities to graduate more than 100 doctoral candidates per one million of the population by 2030. This equates to an

increase from 1420 per annum in 2010 to 5250 doctorates per annum in 2030. At last count, in 2018, South Africa graduated 3344 doctoral candidates or 58 doctorates per million of the population.[12]

The National Development Plan also envisaged South Africa as a regional hub for higher education and training, particularly for students from the SADC. If South African higher education wants to achieve its doctoral graduate targets, it will have to enrol more students – not only from South Africa but also from the rest of Africa and the rest of the world. Sehoole[13], drawing on 2009 data, showed that South Africa was already establishing itself as a regional hub for doctoral candidates by attracting more doctoral students from Africa than from anywhere else globally. In 2015, Cloete et al.[14] also explored South Africa's status as a hub for doctoral students from the rest of Africa. They found that South Africa, despite a lack of a supportive national policy environment, was well placed to maintain and strengthen its position as the prime regional destination for doctoral candidates from the rest of Africa.[14]

In 2017, the government published the Policy Framework for Internationalisation of Higher Education in South Africa. The policy is a classic example of politically correct 'policy speak' as it is fraught with ambiguity and contradictory objectives. 'Appropriate measures will be developed […] to attract and retain international talent […] e.g. some foreign nationals graduating with PhDs at South African higher education institutions and graduates in scarce skills', but this 'must not be to the detriment of job opportunities for equally qualified and experienced South African citizens'. And then: 'Initiatives to attract and retain international talent from other African countries must be balanced against South Africa's obligation towards the development of the African continent'[15]. No indication is provided how these apparent contradictions will be resolved.

Given the critical role of the doctorate in the production and reproduction of knowledge, and of South Africa's established position on the continent as the prime destination for doctoral study, in this article we focus squarely on doctoral education and the prospects of South Africa as a PhD hub for the continent. We pose the following three questions: Is South Africa maintaining its position as a PhD hub for students from the rest of Africa? If so, what are the predominant factors influencing their selection of South Africa as a destination for doctoral study? And how do doctoral students view their prospects post-graduation?

In the sections below, the issues of reproduction and development, of mobility, and of diversity in relation to doctoral education are briefly explored in the context of Africa and South Africa. Reference is made to both the extant literature as well as to relevant policy. The purpose for doing so is to provide some context in which the main questions posed can be situated.

Literature review

Reproduction and development

The 'production' of doctorates is typically linked to its scholarly function of fulfilling the needs of the academic labour market.[16-18] Through doctoral education, future faculty are trained through a process of socialisation and research training. In Africa, and in other developing countries, the argument is made that there is an urgent need for doctoral graduates to take up academic posts to compensate for the relatively low numbers of academic staff with doctoral qualifications.[8] For example, only 43% of all permanent academics in South African universities had doctorate degrees in 2014[19], limiting the capacity of the system to supervise future doctoral candidates. Jørgensen[20] found that 33% of staff had a doctorate in 28 sampled institutions in Southern Africa in 2012, compared with 31% of staff in 29 institutions in Latin America and 49% of staff in 28 institutions in East Asia. The situation at several of Africa's leading research universities is no better.[21] A 2012 study in the UK showed that 58.4% of full-time staff had doctoral degrees.[22] More recent data for South Africa show that, by 2018, the proportion of permanent academic staff with doctoral degrees had increased to 47%[12] – well below the clearly ambitious 2030 target of 75% set by government[10,23].

In addition to securing the future of the academy, the doctorate is seen as providing high-level skills for the labour market.[16,14,24] The provision of skills links doctoral education to economic development by placing the emphasis on human capital. In South Africa, the initial thrust of policy was to 'address the local human capital requirements' because 'doctoral graduates [are] required to support a competitive knowledge-based economy'[25]. These and other policy statements suggest that national policymakers are concerned with addressing a human capital problem and view the doctorate as a mechanism for developing high-level skills. This should be read against emerging critiques of solutions premised on human capital such as arguments based on the idea that 'there's a strong ideological component behind the skills gap [argument]: it diverts attention (and policies) from the deep inequalities and market fundamentalism that created the unemployment crisis, and focuses on a fake skills gap that had nothing to do with the surge in joblessness'[26].

These two positions on the role of doctoral education suggest that the doctorate's knowledge production role is seen as the reproduction of the academy, while the skills produced contribute to a more productive economy. In this formulation, what is not evident is how the new knowledge produced by doctorates – during their training and in their future positions – makes an important contribution to development. As Backhouse[16] states in her assessment of the South African doctoral education: 'doctoral students are being trained to do research, rather than being engaged in doing research'. Based on a thematic analysis of 995 papers published between 1971 and 2012 on the topic of doctoral studies, Jones[24] identified six central themes covered by the corpus. None of the themes identified relates to the relationship between doctoral education as a knowledge endeavour and development. This may suggest a relatively recent recognition for doctorate's development value beyond the provision of high-level skills for the labour market.

South Africa's National Development Plan articulates the knowledge contribution of doctoral education to development. The first draft of the *National Development Plan: Vision 2030*[10] embraced the knowledge economy, declaring that 'knowledge production is the rationale of higher education'[10]. This is a radical departure from the traditional role of higher education in Africa.[27]

In a context of the increasing focus on the knowledge economy, the argument put forward is that if information and knowledge are the new electricity of the economy[4,28], then it is reasonable to assume that the university – as the main knowledge institution[29] – will become increasingly important, and that its apex training product, the PhD, will become more important and sought after.

The developmental contribution of doctorates places high value on attracting the best students to universities and to national university systems. The attraction of talent or 'talentism' is seen by some as superseding the importance of capital in modern economies.[30] The quest for talent finds expression in initiatives such as the UK's Research and Development (R&D) Roadmap which seeks to 'attract global talent, cut unnecessary bureaucracy and cement the UK as a world-leading science superpower'[31]. The government announced in June 2020, as part of the new Graduate Route, that international students who complete a PhD in 2021 can stay on in the UK for 3 years after study to live and work. Students who have successfully completed undergraduate and master's degrees will be able to stay on for 2 years after study. And a new Office for Talent is to be set up to make it easier for leading global scientists, researchers and innovators to live and work in the UK. Universities UK Chief Executive Alistair Jarvis said the announcement of extending the Graduate Route is a 'bold policy move which will increase the UK's competitive edge in the global competition for talented research students'[31].

Africa has been no exception in embracing the value of doctoral education, despite the fact that there is doubt as to whether any of the extractive-driven economies on the continent are knowledge-driven. This did not deter the African Union Commission Chair, Nkosazana Dlamini-Zuma, declaring that 'Africa must look at ways to train thousands more PhD students on the continent'[32]. Delegates from the African Research Universities Alliance concur that the role of African universities has

changed in the wake of the so-called Fourth Industrial Revolution, and that this requires universities to provide more doctoral training.[33]

Mobility

Knowledge migration, as the movement between universities as sites of knowledge, is inevitably a *relationship* between the students and scholars of different nation states. This is because the impetus for migrating is a factor of conditions in the country of origin, while the incentives put in place to encourage migration, postgraduate participation and the possibility of residency, are the prerogatives of the host nation. In other words, place matters because universities and the countries in which they are situated cannot be separated from the prevailing geo-politics and historically determined power relations.[34] Migration must therefore be understood in comparative terms.

This perspective supports the conceptualisation of contextually determined push and pull dynamics in determining whether students and scholars elect to migrate to countries other than their own for the purposes of education. The push–pull model suggests that students are 'pushed' from their home countries due to a lack of educational and other resources, and are 'pulled' to foreign countries to obtain better education and longer-term prospects.[35]

A 2014 survey of 1682 international students studying in South Africa found that pull factors among students from the rest of Africa (76% of the sample) include affordable tuition fees; proximity to home, affordable cost of living and social connections; the reputation and relative stability of higher education in South Africa; and the currency of qualifications obtained from South African universities in relation to employment prospects.[36] An increase in the number of academic staff from Africa may also play a role in attracting doctoral students from Africa.[8] A study on the retention, completion and progression rates of postgraduate students in South Africa[37] found that the three top reasons cited by non-South African doctoral students in choosing their doctoral degree qualification was the (1) academic reputation of the university, (2) their relationship with their (previous) academic supervisor, and (3) the availability of scholarships or bursaries. Kahn and Oghenetega[38] found that the high quality of academic programmes offered by South African universities, funding made available by South African universities and research funding agencies, and the availability of speciality programmes were the three main reasons for students from Africa selecting South Africa as a study destination.

At the same time, students from Africa face challenges that limit their mobility, such as the uneven application of study visa regulations.[39] Sporadic outbreaks of xenophobic attacks and campus instability following the rise of the Fallist student protests may also have tarnished the reputation of South Africa as an educational destination. Globally, the COVID-19 pandemic has unexpectedly halted the mobility of students. At the time of writing, movement remains barred to and from top doctoral destination countries such as the USA, Canada, the UK and Australia.

The brain drain perspective on migration and development takes mainly the perspective of the origin country into consideration. Migration is seen as detrimental to the development prospects of the country of origin. The brain circulation perspective[40] moves the discussion forward by suggesting that there are residual returns to the country of origin. From this perspective, the prospects of a better life post-graduation in another country may well influence the decisions of doctoral hopefuls and graduates when selecting a country of study and when choosing whether to remain in the country of their choice post-graduation. According to some, the economic and political factors that shape opportunities for graduates are often overlooked.[41,42]

Saxenian[40] describes 'new modern-day Argonauts' – technically skilled entrepreneurs who travel between Silicon Valley and their home countries as they seek to make their fortune. She shows how 'brain drain' has become 'brain circulation', and a driver for the development of formerly peripheral regions. The new Argonauts exploit their Silicon Valley networks and experience, and the ability to operate simultaneously across territories to identify market opportunities, locate foreign partners and manage cross-border business operations. Critically, Saxenian's new Argonauts offers a fresh perspective on how technology entrepreneurs build regional advantage to compete in global markets by arguing convincingly that the foreigner Argonauts have made America richer, not poorer. In the African context, there is anecdotal evidence that increasing numbers of doctoral graduates who pursued their studies abroad are returning home to Africa.[43] Kahn and Oghenetega[38] found that, based on a relatively small sample, 27.5% of 463 doctoral students from the rest of Africa remained in South Africa, 63.8% returned to their home countries on the continent, and 5.0% relocated to countries outside of Africa.

Despite an acknowledgement of the potential benefits of brain circulation, relatively little attention has been paid to the impact of knowledge migrants on the host nation, particularly in cases where regional hubs such as South Africa face their own post-colonial development challenges. The dilemma facing South Africa is, without the resources and system dynamics of Silicon Valley[14], to attract top doctoral students from the rest of Africa to contribute to the country's knowledge capacity, but not at the expense of developing local talent, thereby setting up a complex tension between underdevelopment and development[7,44]. Whether attempts to manage this tension result in brain gain, brain drain, brain circulation or some other form of brain economics, remains an open question.

Diversity

Diversity in higher education is both an established imperative and an ongoing concern as new issues emerge in changing contexts.[45] Research in the USA[46], Europe[47,48] and elsewhere continues to bring issues of diversity and the attendant complexities of its institutionalisation into the academic discourse. The argument for diversity is that the effectiveness, excellence and viability of universities depend on their diversity and, consequently, their ability to deliver on the promise of development, particularly in relation to the production of democratic societies.[45]

As student mobility globally and within Africa increases, so does the national diversity of students, including doctoral students, as they seek opportunity to further their studies at the limited number of research universities on the continent.[14,21] Diversity has been and remains a policy priority in South African higher education, including doctoral education, where it is subsumed under the dominant discourse of transformation.[14] The South African PhD Project launched by the National Research Foundation (in partnership with the then Department of Science and Technology) in 2007 seeks to intensify the strength and diversity of the higher education system by increasing the number and diversity of PhD graduates.[49] The most recent White Paper of 2013 sets out a vision of a transformed post-school system which it sees as integral to improving the economic, social and cultural life of South Africans: 'one that will be more equitable, much expanded and more diverse'[11]. While the White Paper does not provide clarity on what counts as diversity, it can be assumed that diversity includes cultural plurality, as well as a mix in the proportion of international students and staff at South African universities.

This policy position on diversity is one which is at loggerheads with other positions taken by government in relation to the regulation of the labour market and immigration.[8] The inconsistency at the level of policy – possibly intentional[39] – reflects perhaps the unresolved tension between knowledge-driven development that is global in its outlook and the persistent pressure to address local underdevelopment in South Africa. It is in this ambivalent context that the question of South Africa's position as a hub for doctoral study for the rest of Africa remains pertinent.

Methodology

Our approach is quantitative and relies on trend data to establish whether South Africa is maintaining its position as a doctoral hub for students from the rest of Africa. Data are critical because many unsubstantiated or partially unsubstantiated claims are made about the state of doctoral education in relation to the number and experiences of African doctoral students in the South African higher education system.[8,50] Our approach provides an update on previously published data on doctoral education in South Africa.[8,13,14,19,36]

We acknowledge Spencer-Oatey and Dauber's[51] argument about the limits of what they term 'compositional approaches' which seek to describe or measure internationalisation, that is, approaches that rely on 'parameters that focus exclusively on objectively countable characteristics'. To address this potential shortcoming, we conducted a survey of doctoral graduates to reveal some of the dynamics at play in the decisions taken by students in Africa who choose South Africa as a destination for their doctoral studies.

In this article, we draw on two sources of data. First, we rely on university performance data extracted from the South African Department of Higher Education and Training's Higher Education Management Information System (HEMIS) to identify trends with regard to African doctoral students in South Africa. We had access to the HEMIS microdata for students and staff from 2000 to 2019 which include demographic information such as nationality. The second source is qualitative data collected by SciSTIP (the DSI-NRF Centre of Excellence in Scientometrics and Science, Technology and Innovation Policy) from a large-scale survey targeted at doctoral students who completed their doctoral studies in South Africa between 2000 and 2019. The survey provided data for understanding post-graduation aspirations and mobility.

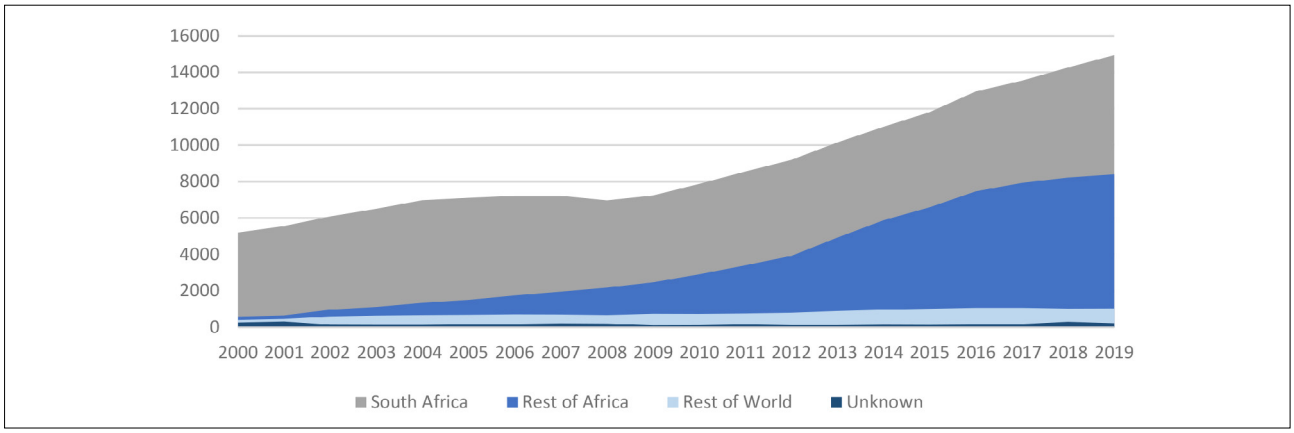
SciSTIP has developed a South African Doctoral Thesis Database which contains records of more than 95% of all doctoral graduates from South African higher education institutions between 2000 and 2019 for whom records exist on institutional repositories. The database includes details such as names, surnames, doctorate-granting institutions, years of degree completion and thesis titles of doctoral graduates. From the database, the research team identified email addresses from public domain sources for all entries who had graduated between 2000 and 2019. This selection produced email addresses for 18 578 graduates in the database. An electronic survey was successfully sent to 15 565 graduates, of which 6452 graduates responded (translating into a response rate of 41.4%). After cleaning the data, which included removing duplicates and excluding respondents who received the survey erroneously, a data set of 6438 observations was analysed using SPSS.

On the basis of four variables, namely gender, age at graduation, nationality and distribution of broad disciplinary fields, our sample of graduates was deemed representative of the population. We summarise the measures of representativeness in Table 1.

Of the 6438 respondents in our data set, 4024 (62.5%) indicated that they were South African citizens during their PhD studies, 1545 (24%) were from other African countries and 429 (6.7%) were citizens of countries outside of Africa.

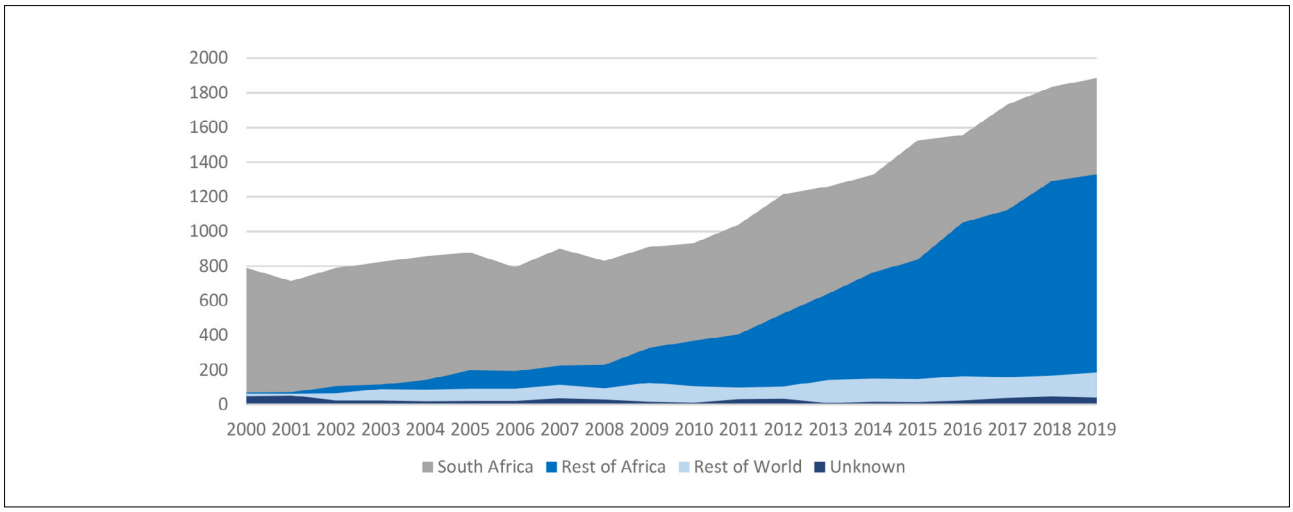
Table 1: Measures of representativeness of survey sample

Variable	Survey	HEMIS (2019)
Percentage female	45.3%	44.0%
Percentage South African	62.5%	54.8%
Percentage Science, Engineering and Technology fields	50.1%	49.9%
Age at graduation	39.8 years	40.5 years



Source: HEMIS microdata

Figure 1: PhD enrolments: Nationality of doctoral students enrolled in South African universities (*n*), 2000–2019.



Source: HEMIS microdata

Figure 2: PhD graduates: Nationality of doctoral graduates, 2000–2019.

Findings

Doctorates from Africa studying at South African universities

Figure 1 shows the steady growth in doctoral enrolments in South African universities, driven mainly by enrolments from South Africa and the rest of Africa. In terms of proportional representation, the data show that, in 2019, 4 out of every 10 doctoral students enrolled in South African universities were international students, with 1 out of 3 being from the rest of the African continent. Over the past 20 years, we have seen a dramatic increase in the number of doctoral enrolments from the rest of Africa with the percentage of African enrolments increasing from 9% in 2000 to 34% in 2019. However, over the past 4 years we see that the rapid growth in the proportion of African enrolments has slowed down and stabilised at around 34–35% of doctoral enrolments. Reasons for the plateauing of doctoral enrolments from the rest of Africa are unknown, and further study is needed to ascertain why this is the case. Possible hypotheses are unsettled university campuses in South Africa post-2015, changing funding opportunities, a tailing off in the number of master's graduates on the continent, and the attractiveness of new study destinations and platforms, to name a few.

When we look at the geographical breakdown of doctoral graduates as illustrated in Figure 2, we observe similar trends to that of enrolments, with significant shifts in the percentage of graduates from the African continent from 7% in 2000 to 39% in 2019, and South African graduates constituting 55% of graduates from South African public universities in 2019.

In Table 2, we show the changes in the percentage of doctoral enrolments from the top 16 feeder countries from Africa. We show the data only for 2012 and 2019 due to a change in coding classifications for nationality in HEMIS. With the exception of Zimbabwe, we see that the top four origin countries in 2019 are not part of SADC. Over the past 8 years, there has been little change in the origin countries of African doctoral enrolments, but with slight increases in the proportion of students from Zimbabwe, Nigeria and Ghana. We see slightly smaller contingents from Kenya, Tanzania, Uganda, Botswana and Malawi, but for the latter three countries the changes are negligible.

Table 2: PhD enrolments from the rest of Africa by country of origin (top 15 countries of origin, 2012 and 2019)[†]

Nationality	Percentage of total enrolments, 2012	Percentage of total enrolments, 2019	Proportional change
Zimbabwe[‡]	7.1%	10.2%	3.2%
Nigeria	4.4%	7.1%	2.7%
Ghana	0.7%	2.4%	1.7%
Ethiopia	2.0%	2.0%	0.0%
Kenya	2.3%	1.8%	**-0.6%**
Zambia[‡]	0.9%	1.1%	0.2%
Namibia[‡]	0.7%	1.0%	0.3%
Lesotho[‡]	0.9%	1.0%	0.1%
Uganda	1.2%	1.0%	**-0.2%**
Cameroon	0.8%	0.9%	0.1%
Eswatini[‡]	0.5%	0.8%	0.3%
Botswana[‡]	0.8%	0.7%	**-0.1%**
Malawi[‡]	0.8%	0.7%	**-0.1%**
DRC[‡]	0.6%	0.6%	0.0%
Tanzania[‡]	0.8%	0.4%	**-0.4%**

Source: HEMIS microdata

[†]Enrolments from South Africa: 65.5% in 2012; 60.8% in 2019

[‡]SADC countries

In Figure 3, we show the percentage of international students at South African institutions for 2005 and 2019 (we selected the first year after the mergers of South African universities). Unisa has consistently enrolled the largest proportion of international students, with more than half of their doctoral enrolments in 2019 constituted by non-South Africans. International students made up around 40% of doctoral enrolments at South Africa's bigger research universities (UKZN, UCT, UP and Wits).

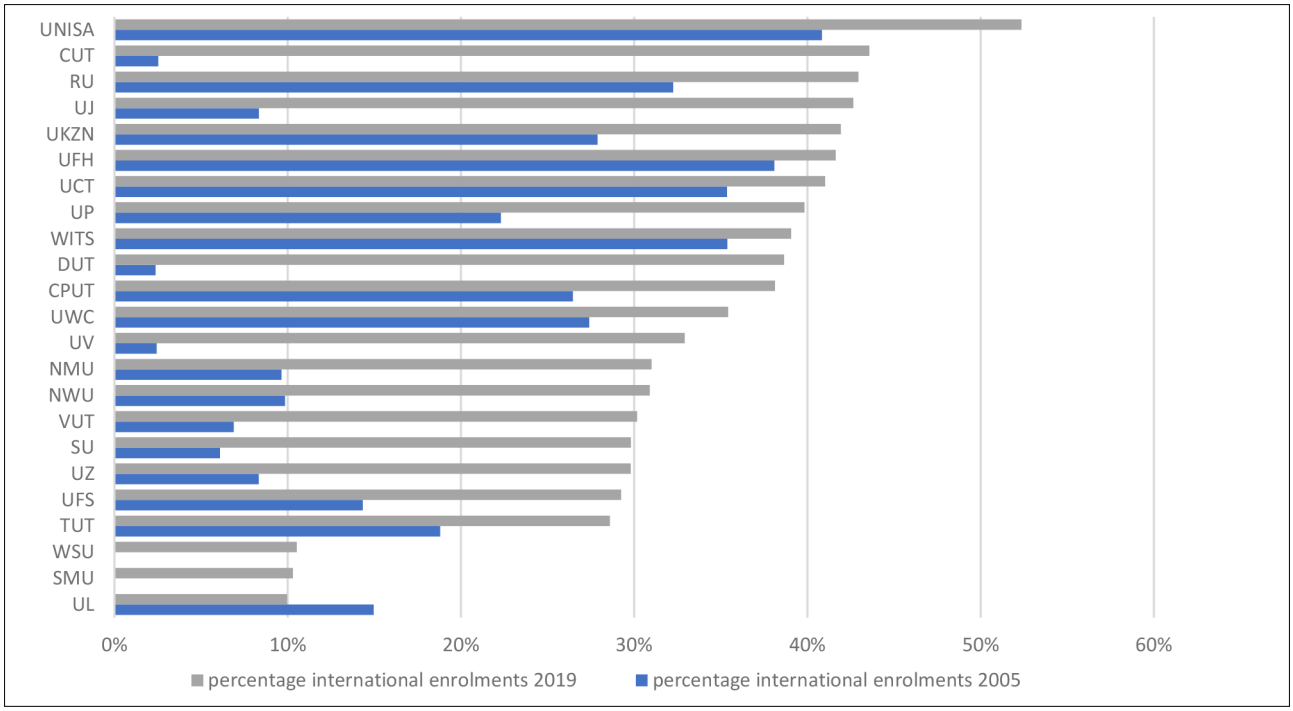


Figure 3: Percentage of international PhD enrolments by South African university in 2005 and 2019.

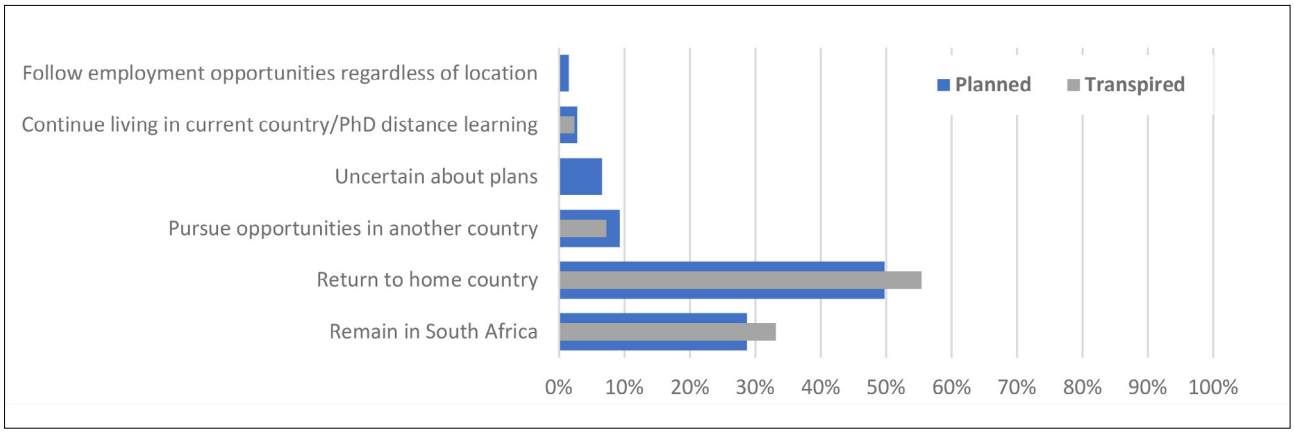


Figure 4: Mobility plans and outcomes of doctoral graduates from Africa.

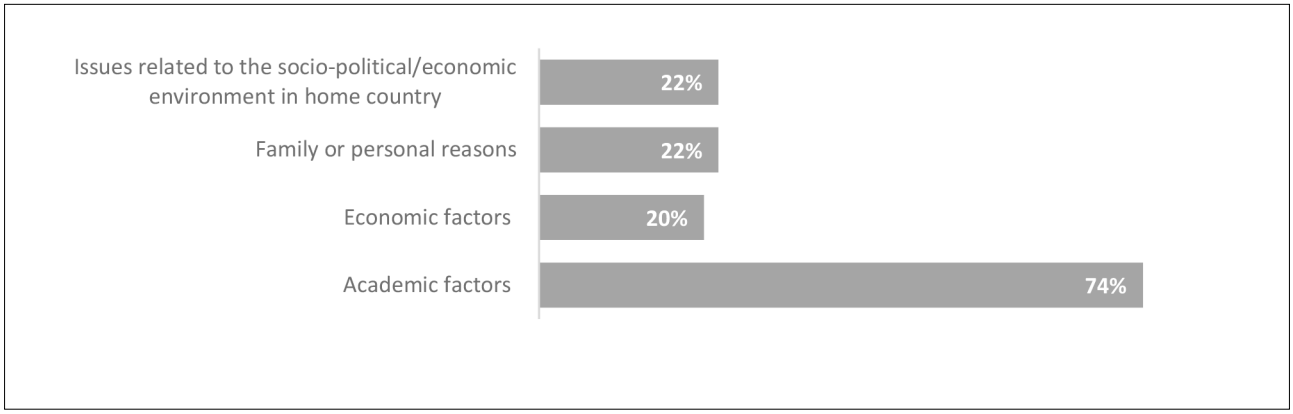


Figure 5: Reasons given by doctoral graduates from Africa for remaining in South Africa.

The prospects of doctoral graduates from Africa in South Africa

One of the aims of the doctoral graduate tracer study was to investigate the mobility patterns of doctoral graduates from South African universities. Survey respondents were asked to indicate what their plans were *during* their doctoral studies and to indicate what had transpired in the first year *after* graduation.

Figure 4 shows that it is evident that most doctoral graduates (50%) planned to return home after their doctoral studies. An additional 5% (55%) indicated that they had, in the end, returned to their home countries within the first year of graduating. A relatively high percentage of respondents also planned to remain in South Africa (29%), and it transpired that 33% of respondents ended up remaining in South Africa.

Of those respondents who remained in South Africa within the first year of completing their doctoral studies, the majority indicated that academic factors constituted the main reason for their decision (74%) (Figure 5). Economic and personal reasons were not cited as frequently as being the reason behind their decision to remain in South Africa.

Table 3 shows that when asked why respondents had left South Africa, family and personal reasons was the most common response (31%), although academic and economic reasons were also cited. Comparatively fewer respondents left South Africa due to issues related to visas (12%) or personal safety (8%). Few had commitments requiring their return to their home country (8%) or had no intention to stay in South Africa after graduating (3%).

Table 3: Reasons given by doctoral graduates from Africa for leaving South Africa after obtaining a doctorate

	n	%
Family or personal reasons	435	31%
Academic factors	265	19%
Economic factors	245	17%
Issues related to visa or residency in South Africa	170	12%
Issues related to personal safety (e.g. xenophobia)	116	8%
Employer/financial condition in home country	109	8%
Had no intention to stay	49	3%
Other reasons	21	1%

Source: HEMIS microdata

Discussion and conclusions

The description of South Africa as a doctoral hub on the continent, particularly for students from anglophone countries, remains an accurate one. Our findings confirm that, for the time being, South Africa remains an attractive destination for doctoral candidates from the rest of Africa.

When compared with the findings of Kahn and Oghenetega[38] that 64% of doctoral graduates returned home, our findings, based on a larger sample and one that includes doctoral graduates from all South African

universities, show that just over half (55%) of respondents returned home after graduating. Our findings show that 33% remained in South Africa compared to Kahn and Oghenetega's[38] finding that 28% remained in the country.

That most respondents indicated that they remained in South Africa for academic reasons squares with Kahn and Oghenetega's[38] finding that 17% of the 28% of doctoral graduates in their study remained in South Africa to pursue postdoctoral fellowships. It also supports the findings of previous studies that found the quality of South African university qualifications to be a strong motivator for selecting and remaining in South Africa.[36,37] This finding does, however, raise questions about whether doctoral graduates from Africa are using postdoctoral positions to mark time until other, longer-term opportunities to remain in South Africa arise. If this is the case, they are, to some extent, fulfilling a role as providers of skills for the academy, but they are less likely to make additional contributions to development if they are unable to secure a permanent university post, find employment in the labour market or engage in entrepreneurial activities. Moreover, the postdoc as temporary solution is under pressure, given indications that funding opportunities for postdocs from the rest of Africa are shrinking (see below).

In terms of reasons for leaving South Africa, respondents cited family reasons as the main reason for returning home. Issues related to personal safety (including xenophobia) and visa requirements played a relatively less important role in influencing respondents' decision to return home but nevertheless deserve attention as it could be argued that the fate of at least one in five doctoral students from the African continent may have been different under other circumstances – circumstances that are predominantly determined by the host government.

The percentage of doctoral graduates from Africa remaining in South Africa, and their reasons for doing so, should be interpreted in a context in which total doctoral enrolments at South African universities are growing, and in which the percentage of doctoral graduates from the rest of Africa in relation to those from South Africa is also increasing. While this aligns with the policy priority of a diverse student population and the retention of potentially valuable highly skilled labour to support the development of South Africa, an increase in doctoral graduates from the rest of Africa nevertheless has the propensity to be used by the South African government to support nationalist higher education and migration policies. The result is a thicket of policies that align selectively with the available data, and which leaves prospective doctoral candidates, doctoral graduates, university administrators and employees of doctoral graduates from African countries confused and frustrated. The consequence is brain circuity instead of brain circulation. In other words, policies related to the treatment of doctoral graduates from Africa, caught between different social, economic and political imperatives, result in contradictory and confusing signals, resulting in neither the circulation nor the draining or gaining of knowledge, but to a knowledge landscape characterised by indirection and unwanted intricacy.

For example, on the one hand, student enrolment and graduation data[52] show considerable progress in terms of equity. On the other hand, the focus on equity, or redress, results in the reservation of doctoral places and financial aid for black South Africans. The current policy of the NRF reserves 80% of funded places for black South Africans, and states that no foreigner may displace a South African citizen at a local educational institution.[53,54] Yet South Africa cannot reach the targets for doctorates set by government without the constant flow of candidates from the rest of Africa. An ARIMA (autoregressive integrated moving average) forecasting model of trends in doctoral outputs shows that the number of doctoral graduates from the rest of Africa is growing at a faster rate than that of South African graduates. If the trend continues, the primary driving factor in the production of doctoral graduates will be the influx of students from foreign countries. Based on the forecasting model for data between 2000 and 2017, there will be a point at which graduates from the rest of Africa surpass those from South Africa.[55]

Another confounding policy issue is that, in the national higher education database (HEMIS) managed by the Department of Higher Education and Training, South African racial classifications are assigned to foreigners. Such classification is both arbitrary and nonsensical. It also creates confusion when using the HEMIS data because non-South Africans are often included in reports disaggregated by race. This creates a misleading picture in terms of system-level transformation and diversity.

Since 2016, nationalism and xenophobia have become more prominent in the public discourse, leading to policies that favour South African black students. Confounding both positions is the policy of increased collaboration and preferential treatment for students from SADC countries when the data show that, in reality, most doctoral students from Africa do not come from the SADC region. Further analyses could include a focus on South African universities' internationalisation plans and agreements which undoubtedly influence the numbers of incoming students.

A positive development is that doctoral graduates from other African countries are more readily granted South African work permits if they meet the requirement of providing critical skills.[56] (These skills are all in technical and science areas; apparently there are no critical shortages in the arts and social sciences.) However, policies that rest on the principle of 'not displacing South Africans', while at the same time extracting scarce skills from other developing countries in Africa, attest to a lack of appreciation as to the scientific and developmental benefits of brain circulation. Such policies are also in contradiction with Africa-wide collaboration and the intentions of the recently signed free trade agreement.[57]

In 1996, the National Commission on Higher Education could not resolve the tension between equity (redress) and development, and this tension still underpins the contradictory policies of the South African government. Rather than supporting the circulation of knowledge for the benefit of all African countries, nationalist politics are stifling the contribution of South Africa's universities as key drivers of development across the continent. Brain circuity is a wasted opportunity.

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Competing interests

We have no competing interests to declare.

Authors' contributions

F.B.v.S.: Formulation or evolution of overarching research goals and aims; development and design of methodology; preparation and creation of the published work, specifically writing the initial draft and subsequent writing revisions; final approval of the version to be published. M.H.v.L.: Formulation or evolution of overarching research goals and aims; development or design of methodology: questionnaire construction, data cleaning and wrangling, survey and data analysis; writing of initial draft and subsequent revisions of manuscript; final approval of the version to be published. N.C. Formulation or evolution of overarching research goals and aims; writing of initial draft and revisions of manuscript; final approval of the version to be published.

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