

Appendix 3

Current trends in PhD studies: A review of articles published on the *University World News* website (2013)

This review prepared by Gill Sloan provides a summary analysis of key themes and trends reflected in 31 articles on the doctorate appearing on the *University World News* (UWN) website for the period January to December 2013. A full list of all references is also provided.

Global themes

Balancing excellence and access (Jørgensen)

- The bulk of doctoral education is provided by relatively few institutions globally and research capacity is still highly concentrated in a few regions: the EU, Japan and US.
- There is a need for a decentralised research infrastructure featuring a culturally diverse set of researchers. Local talent should access and receive training in the community without being absorbed in the few hubs where capacity is concentrated.

Too many doctorates? (Maslen 2013c)

- Governments are beginning to ask if it is time to slow the PhD production line. This stems from a recognition that many PhD graduates are unable to find academic positions and that a high proportion of those who do may find themselves working in casual or part-time appointments.
- Questions have been raised about the quality of PhDs produced and the relevance of the training students receive, given the employment opportunities on offer. There is debate about the kinds and the breadth of non-research skills that PhD graduates need or can reasonably

acquire to make them more competitive in the job market against those with bachelor degrees and with work experience.

Future mobility trends (Choudaha)

- Mobility of international students at doctoral level over the next 20 years will be shaped by both an increasing number of undergraduate-level students in developing countries who qualify for and aspire to a doctoral education, fuelling mobility; and by the improving quality of the higher-education system in source countries, stemming mobility.
- In terms of stay rates: students who go abroad to earn doctoral degrees may return home to work because of improving opportunities in their home countries; in addition, the proactive immigration policies of host countries will strongly encourage international students to remain away from their home countries.

Themes across regions and countries

Increasing doctoral graduate numbers and quality

Africa: Survey reveals strategies to increase PhD production (Lee 2013b)

- A survey of eight institutions in Africa – the Universities of Cape Town, Pretoria, Rhodes and the Western Cape in South Africa, the University of Nairobi in Kenya, Makerere University in Uganda, and the Universities of Ibadan and Obafemi Awolowo in Nigeria – indicated efforts to increase PhD production.
- Doctoral fees are being waived at levels of 75–100%, or funded with postgraduate development funds, scholarships, research and conference grant schemes, and by three-year funding packages.
- Lecturers are, in some instances, required to hold PhDs, with some universities promoting staff completing PhDs and providing small financial rewards to staff completing masters and PhD qualifications. Five universities reported an increase in the number of staff with PhDs, and another an increase in staff enrolling for PhDs.
- Supervisors have a set cap on the number of students they can work with at any time, minimum requirements for supervisors have been set, and complementary models of supervision allowing more flexibility and coherence, as well as improved supervisory capacity, have been introduced.
- There has been focus on increasing publications from doctoral theses, with some universities encouraging or requiring students to produce at least two publications in internationally acclaimed peer-reviewed journals before graduation.

- Doctoral offerings have been increased or restructured to include coursework, examinations and thesis programmes. Universities have appointed directors or doctoral committees and restructured or established postgraduate schools and offices.
- Transdisciplinary courses have been introduced, covering advanced research methodologies, philosophy of methods, advanced gender-research studies, statistical methods in research, qualitative data management, scholarly writing and communication skills. Non-academic support for postgraduate students has been expanded to develop academic-skills development, professional-skills development and doctoral careers. Clear rules for doctoral enrolment and training have been provided.
- Most universities have strengthened their networks and established strong partnerships to encourage doctoral studies. Some have set up exchange agreements with other African and overseas countries.
- Challenges were lack of supervisory capacity, inadequate trainer capacity, inadequate incentives for supervisors and difficulty in finding lecturing replacements for staff taking sabbaticals.

Africa: Where to from here for the African PhD? (MacGregor 2013b)

- In November 2013, higher-education leaders, experts, funders and journalists gathered for a two-day workshop on 'Expanding and sustaining excellence in doctoral programmes in sub-Saharan Africa: What needs to be done?' The workshop was convened by South Africa's National Research Foundation (NRF) and the Carnegie Corporation of New York.
- There was agreement that Africa needs tens of thousands more PhDs in order to renew an ageing professoriate and staff, rapidly expand higher education, boost research and generate high-level skills for growing economies in Africa.
- It was also agreed that the way that PhD education in Africa is conceptualised and delivered needs to be realigned to African-led priorities.
- Many African universities cannot carry out their research mandates effectively and under-development has placed limits on the flourishing of postgraduate education, affecting PhDs especially.
- Sub-Saharan Africa currently contributes only 0.7% of the world's scientific output.
- Capacity needs to be strengthened for the whole pipeline of early-career researchers, postdoctoral fellows and doctoral candidates, so that they can take part in a changing knowledge economy.
- In South Africa, national policies assume quality but do not reward it; policies also overlook both the roles of supervision in PhD production and of part-time students (often the case for PhDs).

- An integrated approach to PhDs, coordinated networks and additional support to focus on capacity development are needed.
- On the African continent, there is a strong need to support PhD training. The gathering identified the African Union, the Association of African Universities, leading African philanthropists and donors as potential partners in this regard.
- Nationally and regionally, governments, regional higher-education and research networks and institutions need to acknowledge and promote PhDs.
- At institution level, recommendations included incentives, resources, effective management, joint accreditation and supervision, and tapping into the knowledge of African professors in diaspora. There was also support for the sharing of PhD programmes and creating vibrant environments for postdoctoral fellows, while still striving to be world class.

Brazil: Brazil's doctoral production lessons for Africa (MacGregor 2013c)

- The remarkable achievements of Brazil in PhD training – from 800 to 12 000 doctorates a year in three decades – could provide a model for African countries trying to expand doctoral production.
- In 2010, Brazil produced 12 000 doctorates and 41 000 masters graduates, a ratio of 3.4 masters per doctorate.
- Prof. Ribeiro of the University of São Paulo outlined two key factors facilitating such growth: strict evaluation by peers and funding from the government.
- Three main evaluation agencies in Brazil deal with science and research evaluation. Evaluation of masters and PhD programmes is done every three years in 46 fields of knowledge.
- The main criterion in evaluation is research quality as transmitted to the student. Other criteria are the impact factor of publications in journals, degrees awarded and their quality, and publication of theses and dissertations. Emphasis is also placed on the quality and distribution of supervisors.
- Programmes are awarded grades from one to seven. Those with very low grades – one or two – are shut down. To offer PhDs, courses must achieve a grade of at least four.
- Programmes with the highest grades of six and seven must help other courses that are less successful. No programme can get a high grade if it has not cooperated with a lower-graded course.
- Funding via the federal agencies is allocated using three main criteria linked to the evaluation grade:
 - Programmes that perform better get more money.
 - Courses in less-developed states receive more funding.

- Based on priorities, some fields of knowledge are funded more than others.
- Most full-time doctoral students receive full scholarships from the government.
- The state makes pedagogical visits to programmes that are performing badly to ascertain the reasons for poor performance and provide advice on how to improve. The same practice is applied to proposed new graduate courses.
- Since 2005, it has become obligatory to publish all theses and dissertations either in a periodical or book or on the Internet.

The brain drain

Arab world: Effort needed to attract postgraduates back home (Sawahel)

- Some 80% of 900 000 postgraduates in the Arab world study abroad, and only 55% of them return home.
- Factors contributing to this trend include the slow rate of development in Arab countries, a failure to make adequate use of new technologies in the productive sector, low salaries and the relative lack of opportunities for scientific research. Broader factors include political and social instability in many countries in the region.
- To stem this brain drain:
 - Universities in developed nations should look at transferring resources, technology and knowledge to African nations via exchanges of staff and students, research collaborations and ‘twinning’ with institutions, along with developing partnerships and networks between scientists and research institutions, with a focus on training for young professionals.
 - Incentives to encourage students to return home after their studies could be established by creating national and regional centres of excellence in Africa and supporting existing centres.

Asia: High stay rates continue (Veugelers)

- The increase in Asia’s own scientific capability does not seem to have led to a greater propensity of Asian PhDs to return from the US, certainly not immediately upon graduation.
- Asian stay rates remain very high. Chinese and Indian PhD students record the highest rates, which have only marginally decreased over time.

Greece: Economic recovery stifled by serious brain drain (Marseilles)

- Emigrants from Greece are highly skilled professionals, with postgraduate qualifications, who are unable to function in the country’s

depressed economic environment. But their leaving is also delaying – even preventing – Greece’s recovery. Of those leaving Greece now, 73% have a postgraduate degree and 51% a PhD, and most have studied abroad in some of the world’s best universities.

- Economic orthodoxy claims that the road to economic recovery cannot take place without young people with fresh ideas, without well-educated executives and managers, without postgraduates who could help rescue the country from stagnation.

Italy: Why highly educated Italians leave home (Constant)

- 30 000 home-grown researchers leave Italy each year, while only 3 000 qualified scientists go to Italy. The main destination is the US, attracting about 34% of Italian brains, followed by the UK (26%) and France (11%).
- The top three reasons cited for international migration are lack of research funding, better conditions abroad from an economic standpoint, and better career opportunities abroad.

Mexico: Emigration of highly qualified Mexicans contributes to US economy (Albo and Díaz)

- Mexican migration to the US is often thought to be a movement of people with low education and income levels, but emigration of highly qualified Mexicans is also significant. In 2010, the number of Mexican immigrants with doctorates in the US represented 15% of all those with doctorates in Mexico.
- Overall, Mexican immigrants in the US provide 4% of its GDP, while the contribution of those with PhDs is larger than other migrant groups because of their higher productivity.

Turkey: PhD students drawn to US for more than a decade (Bilecen)

- Although Britain sent more than 9 000 students to the United States in 2012, and Germany sent about 9 300, both lagged behind Turkey, which has been sending more than 10 000 students a year to the US since 2000.
- The biggest flow of Turkish students to the US is at the PhD level, followed by their settlement there after graduation.

A rise in foreign PhD enrolments

Australia: 37% of PhD students are from other countries (Maslen 2013a)

- The proportion of international students starting a PhD jumped from 21% in 2002 to 37% in 2011, when more than 4 000 international students joined 7 000 locals to start a PhD programme.

- In many disciplines it is now unusual for students to move directly from an undergraduate degree to postgraduate training or to be doing their PhD full-time. In 2011, the average age at commencement of a PhD was 33, while a 2010 survey found more than 10% of research students were aged from 50–59.
- The global mobility typical of those seeking or being awarded a doctorate tends to cease when foreign students obtain their degrees in Australia, and a significant proportion stay on as permanent residents. Government amendments to the immigration rules in recent years mean that a student who earns a PhD will now almost certainly qualify for a residency visa.

India: Brain gain counters brain drain in attracting PhDs (Mishra)

- Only 5% of Indians who go to the US to earn a doctorate degree return home, as shown in a study on the mobility patterns of PhD graduates in science, engineering and health.
- India also has the largest diaspora, with 40% of its home-born researchers working overseas and 75% of its scientists going to the US. A major reason behind the brain drain is the divide between universities and specialised research institutions, with most universities not engaged in cutting-edge research and unable to attract the best minds.
- Now the government and industry, along with India's elite universities and technical institutions, have united to implement a series of measures to stem the tide while also encouraging large numbers of researchers to return home.
- India's new science policy aims to position the nation among the top five global scientific powers by 2020. This cannot be achieved without qualified academics, researchers and scientists. As the nation's elite institutions try to morph from world-class teaching institutions into world-class research centres, they have put in place flexible recruitment policies, generous research grants and industry-academe collaborations to attract their researchers back from foreign institutions.

Scandinavia: Increasing foreign enrolments (Myklebust)

- Across Scandinavia, the overall number of doctoral degrees conferred increased by 32% between 2002 and 2011, whereas the number of foreigners awarded a PhD jumped by an astonishing 121% in the same period. There was also a 46% stay rate amongst those who were awarded doctorates in 2011.
- Foreign students accounted for 37% of newly enrolled doctoral candidates in Sweden in 2011 and 24% in Denmark, both representing steep rises over the previous decade.

- The proportion of foreigners awarded a doctorate in 2011 was 33% in Norway, 29% in Denmark, 22% in Sweden and 14% in Finland. In the same year, Iceland awarded 51 doctoral degrees, being 38% of the total.

United Kingdom: Almost 40% of UK postgrads are from other countries (Osborn)

- Over 2011–12, there were nearly 2.5 million university students in the UK, with more than 550 000 undertaking postgraduate studies; 38% of these postgraduates were from outside Britain.
- Only 54 000 international postgraduate students were from other European Union (EU) countries, a figure dwarfed by the 96 240 postgraduates from Asia, with the major shares represented by China (37 876) and India (21 765). Another 20 585 postgraduates were from Africa and 14 640 from the Middle East.
- To date, the UK has not used its regulatory system to encourage postgraduates to stay on after qualifying.

Incentives to encourage staying

Europe: Blue Card aims to lure the highly qualified (Maslen 2013b)

- The European parliament has backed the adoption of a ‘Blue Card’ as an EU-wide work permit that would attract high-skilled non-EU citizens to work and live within the European Union.
- Those applying for a card must have a recognised diploma, evidence of at least three years of professional experience and the offer of an EU job contract with a salary three times the minimum wage.

France: Tackling administrative difficulties to attract more foreign PhD students (Marshall)

- About 70 000 PhD students are studying in France, of whom 41% are from abroad; 24% of the 6.4 million PhD (or equivalent) graduates living in France are foreign.
- While academe and industry appreciate the value of having large numbers of highly qualified foreigners working in France, the bureaucracy and lack of information that foreigners experience when dealing with embassies abroad and the prefectures in France that control their residence rights makes life difficult. Particularly problematic is obtaining a long-term visa, which is essential for opening a bank account, travelling and qualifying for a housing allowance and for social security.
- The government is now introducing a series of reforms to attract the brightest foreign students to study in France.
- These measures include construction programmes for student housing; two- to three-year student visas, depending on the kind of

degree concerned, to avoid the hassle of renewals; one-stop shops for simplified administrative and academic processes; and relaxed labour laws to allow highly educated foreign graduates easier access to employment in France.

- Furthermore, unlike in many other host countries, fees in France are low: for a doctorate, fees are only €380 (USD 500) a year.

Netherlands: Foreign PhDs urged to stay (Myklebust and Beerkens)

- The number of doctoral candidates in the 13 Dutch universities jumped by almost 60% in the decade to 2010, and is now close to 4 000 students each year. The first five years after 2000 saw the third highest growth rate of international students in the world in the Netherlands, after South Africa and New Zealand.
- The Dutch authorities have tried repeatedly to address the imbalance between more doctorate holders leaving the Netherlands than those who graduated from local universities or migrated to the Netherlands with a degree taken elsewhere.
- In 2008, the proportion of foreign students at doctorate level was 20%. In 2010, 50% of PhD candidates at the three technical universities were foreign, with 60% from Europe, 25% from Asia and Oceania and 10% from North America. The percentage of international employed PhD candidates for all universities was 45% in 2010, up from 35% in 2006.
- Factors contributing to this increase include:
 - The output-based financing in the Dutch system, through a so-called PhD premium where universities receive around €90 000 (USD 116 000) for each graduate; and
 - Foreign PhD candidates increasingly coming to the Netherlands to pursue the degree while being funded by their own governments.

Portugal: Reversing decades of brain drain (Heitor, Horta and Mendonça)

- Analysis of the flux of doctorates in Portugal over the period 1970–2010 shows a positive flow of doctorates in Portugal in 2010, after four decades of consecutive lagging behind in terms of scientific capacity.
- Portugal faced the challenge of overcoming a decades- or centuries-long gap in scientific and technological development, to surpass by 2010 the average OECD level in terms of researchers per thousand people in the workforce.
- This was accomplished by public investment in science associated with policies facilitating the co-evolution of human capital formation and institutional capacity building.

- As a result, the number of doctorates grew by more than 74% between 2000 and 2010.
- Out of a total of 19 876 PhD holders who completed their PhD at a Portuguese university, only 669 (3.4%) were found to be working abroad, while 1 836 foreign PhDs were working in Portugal, of whom 83% were engaged in research and development activities.
- The key factor in this achievement was a major, long-term, publicly funded and centralised programme of research grants for doctoral and postdoctoral projects, based on national evaluations of individual proposals that were independent of any university or research institution.

Russia: Government plans to attract foreign postgraduates (Vorotnikov)

- Foreign students in Russia's universities currently number some 250 000, of whom about 20 000 are postgraduates, which is significantly lower than during the Soviet period.
- 40% of all foreign students, including postgraduates, find a job in Russia after graduation, while more than 50% – mainly from Africa and other developing countries – return to their homeland. The remaining 10% find work in Europe or the US after confirmation of their Russian diplomas and passing of additional exams to prove their qualifications.
- The Russian government is considering creating conditions to persuade foreign students, including postgraduates, to continue their education in the country. The measures include abolishing the existing system of quotas for admitting foreign students to Russian universities, providing employment assistance, eliminating administrative barriers associated with employing foreigners, and increasing the number of scholarships, whose amounts are currently below the living wage.

Spain: Efforts to retain doctoral graduates (Rigg)

- Spain saw a sixfold increase in the number of doctorates awarded over 1978 to 2004; and in 2010, it was placed fifth in terms of European PhD production. Data for 2012–2013 showed that nearly 24% of the 8 000 doctorates awarded were earned by foreign students, of whom 62% were from Latin America and 27% from Europe, with only 4% from Asia-Oceania and 4% from Africa. It is not clear whether these students stayed in Spain once they received their doctorates but some evidence suggests the students may be in transit and on their way to continue their research back home.
- Spanish and Portuguese universities are at the bottom of the European pile in terms of offering fixed-term contracts.

- The two major hurdles that foreigners outside the European Union face are legal problems related to visa acquisition and language barriers, especially regarding administrative procedures. The Spanish government sought to address this by introducing special scientific visas under the Immigration Act to ease researchers' inward mobility.
- Another major obstacle for postdoctorates in Spain has been the low level of staff mobility in universities, which is directly related to the way recruitment occurs. National policies have long sought to tackle the perceived common problem of inbreeding, including imposing mobility requirements in some postdoctoral programmes.

Incentives hampered by limitations in the environment

Canada: International PhD candidates not finding jobs to stay (Millar)

- An ambitious programme intended to attract the world's brightest talent to Canada, the Vanier Canada Graduate Scholarship scheme, was launched in 2009 and offered USD 50 000, three-year scholarships to up to 500 new PhD candidates a year. So far, 660 scholarships have been awarded: 164 to students from Africa, Asia, Europe and the United States.
- The government also changed the immigration rules to attract doctoral students to Canada so that from November 2011 PhD students could apply for permanent residency through the Federal Skilled Worker Programme, with the government pledging to accept up to 1 000 applicants annually.
- Although Canada has more than doubled the number of international PhD candidates studying there in the past five years, highly educated immigrants face worse job prospects than their Canadian-born counterparts. Discrimination appears to be at the root of this. This is likely to cause many to leave the country in the long term.

China: Return scheme not showing long-term results (Sharma)

- The Chinese government is regarded as being among the most assertive in the world in introducing policies to reverse the brain drain of scientific and entrepreneurial talent as part of its aim of becoming a global economic and science powerhouse.
- China's high profile 'Thousand Talents' scheme to lure back academic high-fliers may, on paper, look like a major success, but there is concern that it is not bringing researchers back to stay full-time, commit to the long-term development of China's science and technology sector and nurture future local PhD talent. Returnees prefer part-time or visiting research posts in China rather than full-time positions, and they are often unwilling to leave tenured positions at major universities in the West.

- 92% of Chinese who received a science or technology PhD in the US in 2002 were still in the US in 2007. For India, the figure was 81% and for Canada 55%.

Prohibitive fees chase away foreign postgraduate students

Sweden: Losing talent through high tuition fees (Adamson and Flodström)

- In June 2010, the Swedish parliament decided that non-European students should pay tuition fees from the autumn of the following year while studying in Sweden. The consequences were dramatic.
- High tuition fees, matching those at Stanford in the United States and prominent universities in the United Kingdom, combined with the extremely limited possibility of scholarships, have made Sweden a far less attractive destination than was previously the case.
- In the autumn of 2010, the number of non-European students applying for a place in Swedish masters programmes plummeted to 25 000 – down from 125 000 the year before – while the number admitted fell from 16 600 to 1 200.

PhD programme offerings and the supervision relationship

Africa: Supporting doctoral education in Africa – A sketch of what is available (Harle)

- An Association of Commonwealth Universities study on funding available to doctoral students in Africa has illustrated how difficult it is for prospective African students to identify and access funding. Doctoral education is still heavily dependent on external assistance.
- While it emphasises that more full-funding is needed, it also suggests that the growth of network, collaborative and regional approaches is important.
- The report highlights the following:
 - While there is a range of funding activity, the need for support still outstrips what is available.
 - Many bilateral agencies and donors support postgraduate study, but predominantly at masters level.
 - Funding is generally earmarked for specific types of research.
 - Many schemes make partial awards for PhD study, meaning that doctoral students must have other support or risk not being able to focus fully on their research.
 - Some doctoral funding is restricted to staff or students within a particular network.
 - Only 11 active schemes supporting PhD study tenable at African institutions were identified.

- Eleven European countries offer awards to African students for study in their respective countries. African students can also apply to European Commission schemes. The UK had 4 130 research students from Africa in 2011/2012.
- Overall, European funding is still relatively modest.
- A popular approach to the challenges of limited supervisors, insufficient resources or a lack of good research-methods expertise is to build capacity at a regional level. Examples are the African Economic Research Consortium's collaborative PhD in economics and the programme in public health run by the Consortium for Advanced Research Training in Africa.
- Grants to attend conferences or summer schools to present papers are very limited.

Africa: Emerging ideas for building PhD training capacity (MacGregor 2013a)

- The Southern African Regional Universities Association (SARUA) is exploring ways to build supervision capacity through collaboration and drawing on strengths of universities across the region.
- An emerging hub-and-spokes model proposes connecting research-intensive institutions with others that are more teaching-orientated to share resources and facilities for PhD training.
- A survey of SARUA member universities showed that southern African universities were interested in collaborating around doctoral training and supervision capacity-building. About 70% of the respondents preferred an initiative in which there is collaboration in training, sharing of staff and equipment, and sandwich courses.
- The proposed hub-and-spokes model is a means of building PhD production and supervision capacity within Southern Africa.
- At the hub would be research-intensive universities, while the spokes would be middle- and lower-research-strength institutions.
- Hubs would be based on areas of strength in the research universities, and virtual regional centres of excellence would be developed.

Africa: Enhancing research through international collaboration (Rüland)

- Rüland, the German Academic Exchange Service (DAAD) secretary general, stated that quality higher education will occur only when the research dimension in universities is improved.
- Graduate education in Africa can be improved by embedding higher education and research within international knowledge networks.
- Universities should also be enabled to become engines of development in national development, well integrated into the global scientific community.

- Higher education in Africa is increasing, relatively rapidly in certain places. But underfunding has left many African universities with inadequate infrastructure, their best talent working overseas and, in many places, an ageing academic staff.
- African countries receive international support from Great Britain, Canada, France and Germany; and more recently from China and India.
- Bottom-up initiatives, such as the African Institute for Mathematical Sciences (AIMS), have emerged, combining national and international public and private funding. AIMS, founded in 2003, has rapidly expanded from one centre in Cape Town to further centres in Senegal, Ghana and Cameroon.
- DAAD provides assistance in strengthening academic institutions in Africa. DAAD research scholarships have trained many African PhD candidates and DAAD has co-funded PhD scholarships with Ghana, Kenya, South Africa and Tanzania. In 2008, DAAD started a programme to establish centres of African excellence at African universities. DAAD also supports the development of quality-assurance structures.
- More graduate schools need to be established and firmly embedded in worldwide academic networks.
- Universities in collaboration with their governments should outline career paths for recent PhD graduates. Allowing returning researchers to continue the research they have started abroad would be a step in the right direction.
- Infrastructure and trained personnel and management are needed; higher education and research must be prioritised at national and regional levels; and collaboration must take place with committed governments and like-minded organisations worldwide, and regionally with linkages between universities and industry.

Europe: Greater transparency needed on European PhD programme offerings (Paun)

- In Europe, doctoral education, which has been mostly based on a traditional model of personal relations between supervisor and student, has since 2007 moved towards professional management that includes quality assurance.
- As a result, there is now a need for more transparency by universities about what they offer through their PhD programmes to better allow students to compare doctoral studies across Europe. This will allow doctoral candidates to consider career-development resources, their research environment, funding and mobility options.

South Africa: Piloting a doctoral supervision course (Tongai)

- An innovative course that aims to produce a new generation of doctoral supervisors kicked off in 2013 at three South African universities.

- It is structured around four themes – power relations in supervision, the importance of scholarship, supervisor practices and supervisor processes.
- South Africa hopes radically to increase its number of PhD graduates and produce more than 100 doctoral graduates per million of the population by 2030. Across Africa, the current academic workforce is ageing and there is a need to produce future supervisors to replace those who will soon retire.

South Africa: Quality, ranking and the changing face of PhD training (Lee 2013a)

- Professor Cheryl de la Rey, vice-chancellor and principal of the University of Pretoria and former chief executive of South Africa's Council on Higher Education, has argued that African universities need to rethink how they understand success factors.
- In Africa, quality is most often associated with the name or brand of the institution, even though universities may have varying quality in their different PhD degrees.
- The South African system offers general and professional doctorates. Professional doctorates comprise 60% research and 40% coursework or work-based training.
- Demand for high-level skills in industry has increased PhD output, especially in the social sciences and humanities.
- Doctoral education is no longer traditional, following a one-student-per-supervisor model.
- Co-authorship and international collaboration is growing; however, this is more of a North–North pattern in Africa.
- Technological advances have transformed a number of disciplines, with research now being linked directly to industry in certain cases.
- Across Africa, there are research institutions with varying levels of capacity and opportunities for collaboration to increase doctoral graduate output.
- South Africa must develop local research agencies and foundations to support connectivity with local and global networks to reach targets across both Africa and within South Africa.
- South Africa needs access to big data and computational power; however, buying data is still expensive.
- Professional accreditation and absorptive capacity in universities and research institutions is important. Filling vacancies at South African universities can be challenging as universities need to make viable propositions to academics to come to South Africa.