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Doctoral training in African universities: recent trends, developments and issues

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Abstract: One of the core functions of universities the world over is the generation of new knowledge through research and innovations. African universities have been facing mammoth challenges, especially on their role in research. This is partly due to their weak internal capacities for research and low numbers of staff with PhDs, which is also crucial for their growth and self-renewal. This article analyses the state of doctoral training in Africa with some insights into its implications for research and knowledge generation. The article is based on the outcomes of a study on Building PhD Capacity in Sub-Saharan Africa which was undertaken by the African Network for Internationalization of Education (ANIE) and the Institute of Education, University College London for the German Academic and Exchange Program (DAAD) and British Council. It covered six Sub-Saharan Africa countries. The study presents the key developments and some key challenges facing research and PhD production in these African countries.

Keywords: Africa; universities; research capacities; doctoral programmes.

Introduction and context

In recent years several transformations have taken place in higher education globally which have also impacted on higher education in Africa (Cloete *et al.* 2011, Jowi *et al.* 2013). One of these has been the growth of the knowledge society, which has made knowledge production key to the success of nations and societies (World Bank 2009, Oyewole 2010, Castells 2011). The capacity of a country to produce, adopt, adapt, disseminate, and commercialise knowledge has become critical for economic competitiveness, sustained economic growth, and the improved welfare of society (Carnoy & Castells 2001, World Bank 2009). Africa, though an important region of the world, has remained at the periphery of the knowledge society (Jowi & Sehoole 2017) leading to its exclusion from the networked society (Castells 2011). Doctoral training is pivotal for research and knowledge production, which are actually the main drivers of today's knowledge society. Compared to the other regions of the world, Africa's knowledge production has been quite low, standing at a paltry 2%, rendering Africa not able to fully participate in the knowledge society (Zeleza 2005, Cloete *et al.* 2011).

While Sub-Saharan Africa has 12% of the world's population, it accounts for only about 1% of the global research output (World Bank 2014). It also has the lowest number of researchers per 1 million of the population, compared to all other world regions. Sub-Saharan Africa has also faced a massive brain drain resulting in the loss of highly qualified staff to the developed countries at a time when the pioneer African academics are aging (Mohamedbhai 2008, Jowi & Obamba 2013, Van't Land 2016). This is aggravated by the fact that institutions lack the capacity for self-regeneration through training of a new generation of academics (Tettey 2009, Jowi *et al.* 2013). The consequence has been a low number of qualified researchers, low research outputs, deficient institutional capacities for research, and inadequate capacity of the universities to respond to escalating societal challenges, leading to more demands and questions about their social relevance.

One of the reasons for this low capacity is the challenges facing doctoral training in Africa, including the capacity and quality of this training (Hayward 2010, Harle 2013, Cloete *et al.* 2015). As a result, in recent years, there has been emphasis on the need to enhance the capacities of African universities for doctoral training and research to enable them respond to the growing needs of their societies (British Council & German Academic and Exchange Service 2017). This has hinged on a recognition of the growing potential within the countries of Sub-Saharan Africa to develop new knowledge and ideas that could help address the challenges faced by the region (Shabani 2010, Sehoole & Jowi 2017). For Africa to take advantage of its opportunities, there is a need to build a supportive knowledge production and research

environment for the development of the requisite human capacities that can enhance research and knowledge production in the region (McGarth 2010, Oyewole 2010). Due to these challenges and developments, doctoral training and strengthening of institutional research in Africa are gaining more attention from governments, institutions, and other stakeholders (Harman 2005, Sehoole 2011, British Council & German Academic and Exchange Service 2017).

Investments in doctoral training and strengthening the research capacities of African universities have thus become imperative. In recent years, there have already been some discernible positive outcomes, especially in the growing number of doctoral graduates in different fields and an increase in research outputs from Sub-Saharan Africa in recent years (AAU 2015) and the rapidly growing numbers of PhD graduates (Harman 2005, Sehoole & Jowi 2017). In Sub-Saharan Africa, the growth in numbers of doctoral graduates and research productivity has, however, been largely a contribution of universities in a handful countries, especially South Africa, Nigeria, Kenya, and Ghana). It is, however, notable that Africa's modest growth in research publications and citation impact is within the backdrop of serious capacity deficits. This require African societies to enhance their expenditure on research and development, which remains far lower than the world average of 1.68%, suggesting that deliberate and concerted efforts need to be put into mobilising funding for research and development (Jowi & Obamba 2013).

As a starting point, the article takes cognisance of several developments that have taken place in Africa's higher education in recent years. These include the rapid expansion of the sector, a sharp rise in access, number and diversity of programmes, quality reforms, improvements in governance and management, and the impacts of internationalisation and developments in information and communication technology (ICT) on doctoral training and research in Africa (Jowi & Sehoole 2017). The sharp rise in student numbers, especially at undergraduate level has seriously stretched the capacity of the institutions and limited opportunities for doctoral training. This is in addition to the rapid rise in the number of institutions in these countries without due consideration of the requisite staff capacities. In Ethiopia, for instance, the number of public universities grew from two in 2000 to thirty-six in 2015 (Nega & Kassay 2017). In Kenya, student enrolment increased from 112,229 in 2006 to 539,749 in 2016 (Commission for University Education 2016). These two snapshots of the growth in the number of institutions and students are just an indicator of the situation in most other countries. With Africa's youth bulge and the growing demand for higher education in Africa, this situation might obtain in several African countries for a couple of years. These are thus some of the developments and challenges that deny the countries and institutions the opportunities to turn these potentials into realities that can benefit local populations.

Arising from the above, there has been a growing focus on the state of doctoral training in Africa. This has mainly been on doctoral training capacities, support systems for doctoral training, the challenges facing doctoral training, and some innovative developments in doctoral training in Africa. The article draws insights from the country cases of the six countries (that is, Ethiopia, Ghana, Kenya, Nigeria, Senegal, and South Africa) that were the case studies for the study on *Building PhD Capacities in Sub Saharan Africa.* The study was conducted by the African Network for Internationalization of Education (ANIE) and Institute of Education, University College of London and was commissioned by the British Council and the German Academic and Exchange Program (DAAD). In each of the case countries, ten universities were selected as case studies. The exception was South Africa where six universities were selected, especially due to the significant research already available on this topic. The selection of the institutions was based on parameters including the age of the institution, location, research productivity, status (public/private), number of doctoral programmes, and accessibility. From these institutions, data was gathered using a variety of approaches, including desk reviews of institutional documents, questionnaire surveys, and interviews with key stakeholders. The main informants included doctoral students, recent PhD graduates, supervisors, heads of department and deans of faculty, and university executives. At the national level, information was gathered from national research councils, regulatory agencies for university education, ministries responsible for university education, development partners engaged in higher education, and relevant private sector agencies.

The study focused on the availability and quality of PhD programmes, their link to national research agendas, national policies and frameworks on research and doctoral training, institutional priorities and policies, funding sources, and the role of international collaboration. The outcomes of the study were published in a synthesis report and country reports. Based on the outcomes, this article puts the case for building supportive doctoral training and knowledge production systems for Africa. It also highlights the various positive developments in this sphere in recent years with a key focus on some bold steps and innovative approaches being made by some countries and institutions.

Capacities and quality of doctoral training

Capacities for doctoral training

As introduced in the above sections, one of the main constraints to doctoral training in several African universities is the scarcity of opportunities for this high-level training. It has been noted that most pioneer African scholars obtained their doctoral

training abroad (Tettey 2009, AAU 2015). This trend prevailed for quite some time until some African universities began offering PhD training. While local training opportunities have grown tremendously, they still remain far from adequate (Hayward 2010, Oyewole 2010, British Council & German Academic and Exchange Service 2017), though situations vary from country to country. This is more so for training in specialised knowledge areas where, due to local capacity constraints, training is still largely obtained in developed countries (Sehoole 2011, AAU 2015). With the developments that have taken place in the sector, there is now shared optimism on the value of developing PhD capacity at home through different initiatives. These are succinctly encapsulated in the Kigali Communiqué (2014) and the Dakar Declaration on Revitalization of African Higher Education (2015). Consequently, it is notable that, over the past ten years, there has been a marked increase in the programme offerings for PhDs in the six countries highlighted in this article. This has been partly due to the rise in numbers and diversity of universities in these countries, fuelled by national policy requirements to strengthen and increase doctoral training. While this growth and expansion are desirable and are already contributing some positive outcomes, they have also brought about other challenges and concerns, especially about the quality of the PhD programmes.

In addition to the implications on quality, the growing demand for doctoral training opportunities has stretched the already deficient institutional capacities (Van't Land 2016). It is notable how governmental steering through of policies, including those related to funding instruments, puts pressure on the institutions and academic staff too, in this instance, the focus on enhanced and quality doctoral training. In several African countries, universities are therefore under immense pressure to develop their academic staff to PhD level to enhance research capacity and quality training in the different programmes. The growing influence and recognition of university rankings and the role of research, publications, and academic quality in the rankings have also contributed to this.

By 2013, doctoral student enrolments in Ghana accounted for 0.5% of all enrolments in the universities. In South Africa they accounted for 1.9%, in Ethiopia for 7.8%, and in Kenya for 1.3% by 2015 (British Council & German Academic Exchange Service 2017). This trend indicates that, from negligible doctoral enrolment rates just about a decade ago, enrolments in doctoral programmes are growing. Of the six countries that were covered in the study, South Africa has the most advanced research system and a more differentiated higher education system comprising traditional universities, comprehensive universities, and universities of technology. The number of doctoral graduates per annum in South Africa almost doubled over the period 2005–14, with a production of thirty-four PhDs per million of the population. The growth in the number of PhD graduates was more pronounced in South Africa's

historically disadvantaged universities and universities of technology, albeit from a low base. The University of the Western Cape (UWC), for instance, increased its number of PhD graduates from 35 in 2004 to 197 in 2014. In Ethiopia, where doctoral education has a fairly recent history, the number of public universities offering these programmes has grown to ten from one in 2005. The total enrolment in PhD programmes increased from 50 in 2005 to 3,135 in 2014/15. In the Ethiopian case most PhD students are enrolled in science and technology fields, which account for about 68% of all PhD graduates. In Senegal, in 2005 it was only Cheikh Anta Diop University that could offer PhD programmes, but by 2015, four of the country's six public universities offered doctoral programmes. Even though the number of private universities in Senegal has grown tremendously, their contribution to doctoral training is minimal, as they focus on undergraduate training.

In Ghana, the number of doctoral programmes rose from 100 in 2005—most of them concentrated at the University of Ghana—to more than 200 in 2017. The programmes are spread across a diversity of universities in Ghana, public and private. The distribution of programmes and enrolments by subject fields varies across the various countries and individual universities. The Kenyan study also demonstrates an increase in doctoral enrolments with much better spread across the older public universities (that is, University of Nairobi, Moi University, Kenyatta University, Egerton University, and Jommo Kenyatta University of Science and Technology) but did not show much diversity of programmes across various universities, with most programmes focused largely on humanities and social sciences.

This rapid expansion in doctoral programmes has unfortunately put enormous pressure on existing capacity, which, in most of the countries, was already stretched. It is, however, important to reflect on the number of PhDs each system should produce to meet the needs of the universities and other sectors. Despite the growth in the number of institutions offering PhDs, with the exception of South Africa, in the remaining five countries, the bulk of research outputs and PhD training is still dominated by just a few institutions, mainly the older and better established public universities. It is, however, important that there are positive developments in enrolments and provision of opportunities for doctoral training. Much in-depth analysis is needed to consider whether all key knowledge domains are covered.

Quality of PhD programmes

Quality of doctoral training in Africa is raising growing concern (Hayward 2010, Harle 2013, Cloete *et al.* 2015) despite the ongoing institutional and even regional-level reforms. Quality has been identified as a key challenge to research and PhD training in several African countries (Oyewole 2009, Van't Land 2016). Several efforts

to improve quality are being made, including strengthening regulatory frameworks, enhancing internal quality assurance frameworks, and strengthening programme accreditation and the quality of the entire doctoral training process. These, however, still fall short of the desired situation, meaning that more still needs to be done to foster better quality for doctoral training. In Nigeria, for instance, due to quality requirements, of the 152 accredited universities, only 63 were allowed to offer PhD programmes by 2017 (Akudolu & Adeyemu 2017).

While there are several challenges impacting on the quality of doctoral training, funding for doctoral training is one of the main ones. This impacts on research infrastructure, quality of the learning environment, support systems for students and staff, and the quality of supervision. These culminate in deficiencies in the quality of the research culture for the socialisation of these young researchers. This weak institutional research culture also links to the poor working conditions and heavy workload for academic staff, with most academic staff taking up consultancies and 'moonlighting' to augment their incomes. The unfavourable working conditions have also been a constraint in attracting African academics in the diaspora. The high workload in addition to the meagre supervision capacity also affect the quality of supervision.

The efficiency of doctoral programmes, especially regarding student completion rates and time spent to graduation, has also contributed to the quality challenges in doctoral training. Most full-time doctoral programmes are planned to take three to four years. In Nigeria and South Africa, the average time to completion of the degree is five years. In Kenya, the average time to completion is six years. While there is a paucity of data on completion rates, South Africa has a completion rate of 45%. There are, however, some vast discrepancies between institutions and disciplines. For example, UWC had a 60% completion rate, while the University of South Africa (UNISA) had 25% (Herman & Sehoole 2017). Dropouts from training programmes seems to be a concern, especially in systems which did not have adequate support programmes for the students. In a few cases, dropout rates were as high as 50%. These have impacts on the efficiency and thus the quality of the programmes and systems.

There are notable developments to enhance the quality of postgraduate training in the highlighted countries. In some instances, the national quality reforms are augmented by wider regional quality assurance frameworks, such as those by the Inter University Council for East Africa (IUCEA) for the East African region. For most of Francophone West Africa, the reforms of the LMD (Licence-Master-Doctorat) in Senegal present an interesting model of restructuring and standardising quality provision which has influenced the region (Dimé 2017). Even with these reforms, funding issues, inadequate numbers of staff with PhDs, poor infrastructure for research, heavy teaching loads, and poor supervision practices remain serious challenges. These elements obtain across the six countries, to various extents. Overall, the ecology of

doctoral education across the six countries suggests quality challenges of various kinds.

Thematic priorities for doctoral training

As stated at the outset, research and doctoral training in Africa should respond to the perennial and contemporary challenges facing African societies. Several of the countries have explicitly aligned their PhD training and research priorities to their national development blueprints. Ethiopia, for instance, with guidance from its national Growth and Transformation Plan (GTP), which prioritises science and technology, requires public universities to focus their research and doctoral training on science and technology fields. Kenya, on the other hand, has focused its research agenda on its Vision 2030, which also has a strong inclination towards the STEM (science, technology, engineering, and mathematics) areas. This is also demonstrated by the priority areas supported by Kenya's National Research Fund (NRF). South Africa has anchored its national research agenda on three main strategies: transforming academia to retain more black academics; developing capacity and expanding PhD training; and developing a viable pipeline for postgraduate studies, focusing on developing a new generation of academics. National research priorities across the six countries seem to focus on science and technology areas with an emphasis on health, agriculture, energy, poverty reduction, food security, infrastructure development, urban development, housing and construction, space science, good governance, sustainable development, and HIV/AIDS. These priorities also seem aligned with the United Nation's sustainable development goals and the African Union's Agenda 2063.

These national priorities also guide research and training at institutional level to a large extent. South Africa offers a good example of how to align institutional research priorities, PhD training, and PhD programmes with national research agendas. According to Herman (2013), most universities in South Africa align their strategic plans and visions with major national policy documents, such as the National Development Plan, the *White Paper for Post-School Education and Training in South Africa*, and enrolment planning by the Department of Higher Education and Training (DHET). At the same time, through various funding mechanisms, the South African government influences and steers the institutions towards national imperatives.

Ethiopia has also implemented various mechanisms to steer alignment between institutional and national research priorities. Addis Ababa University, for example, has a research incentive policy to support research, which is aligned with national priorities, and encourages publication of research by academic staff. Some Ethiopian universities also have competitive research funding aimed at supporting priority research areas. One of the limitations of utilising funding for steering research to

achieve a desired alignment is its inadequacy. While almost all Ethiopian universities have identified research themes that are aligned with national priorities, implementation has been slow due to lack of funding (Nega & Kassaye 2017). The situation in Ghana highlights the fact that lack of research funding by government may lead to 'goal displacement' in research focus, as funding from donors and consultancies may not necessarily align with national priorities. There is also the establishment of research institutes and centres to champion research in particular priority areas, the introduction of PhD programmes in niche areas that are aligned with national priorities, and the establishment of research chairs, such as is the case in South Africa and Kenya. By 2018, Nigeria was in the process of establishing a National Research and Innovation Council (NRIC) as well as a National Research and Innovation Foundation (NRIF), which was to be responsible for setting national priorities on research, innovation, and development, and the awarding of research grants.

While all the countries in the study have identified broad research priorities and most universities' research plans were aligned with these priorities, the match between PhD research foci and these priorities is, in some instances, misaligned. This is mainly because of the lack of or inadequate funding aligned with the respective priority areas or capacity constraints. For example, in spite of Kenya and Senegal prioritising doctoral enrolments in science and technology fields, a significant majority of doctoral enrolments in these countries is in the social sciences and humanities, due to inadequate funds to steer enrolments to the set priorities. It is notable that having national research priorities is by itself is no guarantee that universities will align their research agendas with these priorities.

National support system for research and PhD training

The pursuit of national research and doctoral training priorities, as mentioned in the preceding section, requires several support and steering mechanisms. Some of the case countries have, to various extents, developed some forms of intervention in this regard. Part of this includes provision of research funding, funding for institutional capacity development for research, funding support for doctoral training and supporting the establishment of research chairs in some departments, and opportunities for fellowships and visiting scholars, among others. The effectiveness of these interventions across the countries is, however, uneven. Kenya has established the National Commission for Science, Technology and Innovation (NACOSTI) and the National Research Fund (NRF–Kenya) to support and steer research. NACOSTI's core role is to steer scientific advancement and technological development in Kenya through the administration of the Government Research Endowment Fund (GREF) which supports scientific research and innovations in science, technology, and innovation priority

areas for national development. By 2015, NACOSTI had funded a total of 433 PhD research projects across all universities in Kenya. It has also established a Research Chairs Initiative, which is aimed, inter alia, at retaining top researchers and attracting Kenyan scientists in the diaspora back into the country. The first two chairs established in 2016 are in health systems and agricultural biotechnology. NRF–Kenya facilitates the advancement of science, technology, and innovation. It mobilises resources and invests them in research and multidisciplinary collaborations among universities and research institutions in Kenya.

South Africa, which has a comparatively advanced national research system in Africa, has implemented several initiatives to enable institutions to align their research to address the national agenda. These initiatives cover the broad areas of research capacity, enhancing the qualifications of academics, transforming the demographic profile of researchers, and research excellence. The National Research Foundation's (NRF) Thuthuka Programme, which was initiated in 2001, is focused on promoting the attainment of PhD qualifications, as well as the development of the research capacity of early career academics employed at South African universities. To address past inequalities, given the country's apartheid history, 80% of all funded grant holders on the PhD track have to be black and up to 60% have to be female (Herman 2013). The South African NRF has also implemented three other initiatives aimed at significantly increasing research capacity in South Africa: that is, the Centres of Excellence (CoEs), the South African Research Chairs Initiative (SARChI), and the National Research Facilities (NFs).

The CoEs, which were initiated in 2004, focus on promoting collaborative and interdisciplinary research with the aim of enhancing research and knowledge production, as well as capacity development on a long-term basis (NRF 2016). SARChI aims to attract and retain excellence in research and innovation at South African public universities through the establishment of research chairs at these institutions, with a long-term investment trajectory of up to fifteen years. The National Research Facilities provide large science platforms and a unique set of critical skills to the broader research community. The facilities include iThemba Laboratory for Accelerator Based Sciences, Hartebeesthoek Radio Astronomy Observatory, South African Astronomical Observatory, South African Institute for Aquatic Biodiversity, and the South African Square Kilometre Array Project. Due to their huge capital cost, these facilities are the only ones of their kind in South Africa. Overall, the various initiatives implemented in South Africa have shaped the alignment of institutional research priorities with national imperatives, led to an increase in the number of scientific research outputs, and also increased research capacity in terms of the number of researchers and academic staff with doctoral qualifications. For instance, between 2005 and 2014, the number of doctoral graduates in South Africa almost doubled: from 1188 to 2258.

The production of PhD graduates is, however, not even across South Africa's twenty-six universities. Nine universities produced 79% of all PhD doctoral graduates in 2014 (Herman & Sehoole 2017).

In Senegal, on the other hand, the Special Fund for the Development of Scientific and Technical Research (FIRST) and the National Agricultural and Food Research Fund (FNRAA) are examples of the mechanisms that have been established to support research directed to national goals. FIRST awards research grants to researchers, academics, and doctoral students in health, food security, agriculture, climate change, energy, the digital economy, and gender as critical national research priorities. FNRA, on the other hand, supports research in the fields of agriculture, livestock, fisheries, agro-industry, water and forestry, hydraulics, and the environment. Nigeria has recently (2016) established a National Research Fund (NRF–Nigeria), which is aimed at advancing research in Nigeria's public HEIs and also addresses the country's developmental aspirations through targeted research. While Ghana has neither a national research policy nor a research fund, it has a science, technology, and innovation policy which is geared at harnessing the country's science and technology capacity by, inter alia, strengthening the appropriate institutional framework to promote the development of scientific and technological research. Globally, PhD training is gaining growing attention and support, including the use of policy and funding instruments, due to the crucial role that it plays in economies.

Supervisory capacities

The starting point of this discussion was pegged on the serious capacity deficits within institutions, especially in regard to staff with doctoral qualifications. This further implies that the institutions have serious deficiencies in supervision of PhD candidates, noting the growing enrolments. This is more pronounced in the newly established public universities and in private ones (Barasa & Omulando 2017). The growth in opportunities for doctoral training has thus not been matched with a concomitant increase in capacity for doctoral supervision, hence straining the existing capacity. In most of the universities in the countries covered in this study, less than 50% of academic staff had PhDs. By 2017, in Ethiopia, less than 20% of academic staff had PhDs. Even though Ghana had about 50% of staff in its universities with PhDs, they were concentrated at the University of Ghana with the rest of the universities having less than 30% of academic staff with doctoral qualifications (Alabi & Mohammed 2017). The Nigerian study shows that the country has a shortfall of about 8000 academics while at the same time about 45% were due to retire within the next few years. This background shows the challenges that universities face in providing quality supervision. Cloete *et al.* (2015) recognise the serious deficits in numbers of qualified

staff in African universities and the impacts this has on PhD supervision. The very few qualified staff end up being overloaded with unmanageable numbers of students to supervise, some of them in far-drawn disciplines. The poor working environment coupled with the poor remuneration for supervision and the inadequate support frameworks for supervision further compromise the quality of supervision. While the staff suffer from this heavy load in a less supportive environment, the students on the other hand are dissatisfied with the quality of supervision (Herman 2013, Cloete *et al.* 2015) and that of doctoral training generally. This was also aggravated by PhD training largely being by a face-to-face model without discernible integration of ICT to support the provision of programmes and supervision. This was, however, different in the few universities, such as UNISA in South Africa, that hinged its training predominantly on online provision. The quality challenges and concerns are someof the reasons why most students prefer taking their training in developed countries where support systems for students and staff are well developed.

University links with industry and the private sector

In most developed countries, university–industry links play a crucial role in fostering research, innovation, and doctoral training. The developed industries also have experts who—through collaborations with universities—can support teaching, research, and supervision in the universities (Herman 2013). In such countries, the universities have long-standing and mutually beneficial links with industry. These play a key role in facilitating the symbiotic relationship between the university and industry. With regard to the countries highlighted in this study, with the exception of South African universities (Herman & Sehoole 2017), the universities in the other countries have not developed proactive links with industry. This could be a two-sided issue as the universities have not adequately responded to the needs of industry while in some countries the industrial sector is still too poorly developed to have any meaningful impact on universities. In most cases (Barasa & Omulando 2017), universities have been challenged to be responsive to the needs of industry.

The South African case demonstrates this especially in the research-intensive universities. These collaborations are manifested in various forms, including industry chairs, opportunities for student internships, product development, and relevant support to these departments. The University of Pretoria, for instance, has more than thirty industry research chairs in different departments. Other than contributing to high-level knowledge production and skills development, industry chairs also ensure that the needs of industry are addressed by the universities. Another important lesson from South Africa is the establishment of national agencies that promote industry–higher education partnerships. These include the Technology and Human Resources

for Industry Programme (THRIP) and the Technology Innovation Agency (TIA). One of THRIP's mandates is to facilitate partnerships between industry, academia, and the government and to provide incentives to industry and academia to collaborate in finding technological solutions and to develop high-level skills in national priorities. TIA's role is to encourage partnerships between small, medium, and micro-sized enterprises (SMMEs), industries, universities, and science councils to develop an enabling environment that supports sector-specific innovations for global competitiveness and to provide funding for such innovations (Herman & Sehoole 2017).

According to Dimé (2017), in Senegal where university–industry linkages have not been that well developed, one of the main developments has been the inclusion of private sector representatives on the governing boards of public universities, beginning in 2017. Though a positive step, the situation suggests that much still needs to be done to foster closer collaborations between the two sectors. In Ethiopia, a ministerial directive was put in place in 2013 requiring universities and other research institutions to develop linkages with industries to develop students' skills through practical training and to undertake need-based research focused on the competitiveness of the industry (Nega & Kassaye 2017). Due to the growing significance of these collaborations, in the East African region the Inter-University Council for East Africa (IUCEA) has been organising a biennial forum that brings together the universities and the private sector to share experiences and create possibilities for collaborations (Barasa & Omulando 2017).

Overall, university–industry linkages is an underdeveloped area that needs to be tapped into to strengthen research and doctoral training profiles of the universities. Due to these generally weak links between the universities and the industry/private sector, the government ends up shouldering most of the responsibility for supporting doctoral training.

Funding for PhD training and research

Funding remains a serious challenge for higher education in Africa (Oyewole 2008, Jowi & Obamba 2013). With the growing student numbers and expansion of the sector amidst other requirements, funding to the universities is direly constrained. Amongst other sectors, research and doctoral training have faced the serious impacts of this underfunding. Funding for university research and doctoral education is generally problematic, which is unsurprising, considering the inadequate funding of higher education in the continent (Jowi & Mbwette 2017). Doctoral education has always had lower priority with regard to funding allocation compared to other levels of education (British Council & German Academic and Exchange Service 2017). This perception underestimates the significant role of such high-level training. The limited

funding in most of the countries has meant that most PhD students fund their studies from private sources.

With the renewed commitment to doctoral training which is also steered by respective government requirements, some countries are beginning to pay attention to providing funding for doctoral training and research. In some of these countries, governments have established national research funds and also developed policies and frameworks for a facilitative and at the same time regulated environment. Generally, funding for doctoral education and research is inadequate (Herman 2013, Jowi & Sehoole 2017) despite commitments by governments and other stakeholders.

Like most African countries, the six study countries spend less than 1% of their GDP on research and development. The inadequate investment in research is also reflected in national and institutional budgets for research. In Ethiopia, for example, the research budget of all universities accounted for only 1% of the total budget allocated to the universities in 2011/12. In Nigeria, research funding accounted for about 5% of university budgets. Even though the actual funding for doctoral education is inadequate, the sources of this funding across all six countries are diverse and include: students fees; student financial aid schemes (such as Kenya's Higher Education Loans Board—HELB), local and international organisations, private sector organisations (such as Nigeria's Petroleum Technology Development Fund), industry, and the business sector. In several of the countries, for example, Kenya, Ethiopia, Nigeria, Ghana, and Senegal, research funding from industry and the business sector was reported to be minimal. Nigeria, however, had an earmarked education tax of 2% on profits of all registered companies in the country, which was then utilised by the Tertiary Education Trust Fund (TETFund) to support research and development of the higher education sector.

In Ghana, academics in public universities receive an annual book and research allowance to support their research activities. In 2015, the book and research allowance stood at about US$1,256 per academic staff irrespective of their disciplinary fields, rank, or research productivity. While this allowance offers some research support to academics, it does not provide sufficient incentives for research. Plans are underway to establish a national research fund to replace the existing book and research allowances. Ghana has also the Ghana Education Trust Fund (GETFund), which, inter alia, provides funding support for research.

A positive development across some of the six countries is the establishment of national research funds that support doctoral education, as is the case in South Africa and Kenya. Senegal has also set up the Special Fund for the Development of Scientific and Technical Research (FIRST) and a project to support the promotion of women researchers (PAPES). FIRST, which was established in 2007, awards research grants to researchers, academics as well as doctoral students, while PAPES

funds projects to enable women from educational and research institutions to advance in their careers (publications, invitations to scientific meetings, participation in thesis juries) or to complete their doctoral theses in Senegal. Research funding support also comes from the Ministry of Agriculture, which administers the National Agricultural and Food Research Fund (FNRAA). An increasingly important source of research funding is external sources, as is discussed in the next section.

Role of international partnerships and collaborations

Internationalisation has grown and taken centre stage in most university activities (IAU, 2010: 150–65, Mohamedbhai 2012, Jowi & Sehoole 2017, Jowi 2017). Though internationalisation played a crucial role in the development of higher education in Africa, most African universities have not taken advantage of the opportunities that it presents. The universities that have led the way in establishing strategic and formidable collaborations have to a great extent benefited from them. IAU (2010) global surveys on internationalisation of higher education indicate that African universities find these collaborations more meaningful in supporting research and institutional capacity building. Part of this has been the training of staff, especially in specialised areas. Some African universities have developed such international collaborations to strengthen their academic programmes and research profiles, and to help set up doctoral programmes. Such collaborations have also been useful in the supervision of students, external examinations, and sharing of research facilities, especially special and costly equipment that may not be available in some of the African universities. They have also been useful for benchmarking and spurring the leapfrogging of the African universities in different knowledge domains.

In recent years, African universities have been appreciating the essence of academic partnerships and collaborations in fostering student and staff exchanges, upgrading staff qualifications, joint supervision of doctoral students, joint doctoral programmes, and research (Jowi & Sehoole 2017, Aart *et al.* 2018). A general trend regarding inter-institutional research collaborations shows most focus on European and American universities, with very few intra-Africa partnerships. Intra-Africa collaborations and research networks have also begun to flourish. The Network for Excellence of Higher Education in Africa (REESAO), which brings together universities from seven French-speaking West African countries, including Senegal, is a good example. This network facilitates partnerships in areas such as joint doctoral programmes and harmonisation of doctoral programmes. The African Economic Research Consortium (AERC) is another example of a research network that is designed to strengthen research and postgraduate education on the continent, focusing specifically on the field of economics.

The University of Ghana, for instance, has developed several strategic partnerships. In 2014/2015, the university received $16,826,747.29 from different international agencies, representing 32% of its total research funding for the year. The university's major donor's include the Alliance for a Green Revolution in Africa (AGRA), the Bill and Melinda Gates Foundation (BMGF), the Danish International Development Agency (DANIDA), the Department for International Development (DfID), the European Union (EU), the Food and Agricultural Organization (FAO), the International Development Research Centre (IDRC), the Leverhulme–Royal Society, the National Institutes of Health (NIH), the United States Agency for International Development (USAID), the World Bank (WB), and the World Health Organization (WHO). A number of these international organisations also provide research funding to universities in the six countries. Some of these organisations have a specific focus (for example, the Bill and Melinda Gates Foundation focuses on malaria research), while others focus on capacity development training, for example, FAO, DAAD, the British Council, WHO, and the Organisation for Social Science Research in Eastern and Southern Africa (OSSREA), which have partnered with a number of Kenyan universities in providing funding and training for PhD students in advanced research methodology.

International collaborations are a vital pathway for supporting research, doctoral education, and institutional capacity in the six countries. The scale and focus of international collaborations varied from university to university, with the older and 'better established' universities having more and stronger partnerships than the recently established universities. In several instances, international collaborations played an important role in addressing national imperatives: for example, skills development in fields that are regarded as important for national development and also funding for research.

Collaborations among higher education institutions, especially those within the same country, could be a useful strategy for addressing the capacity constraints experienced by many of the institutions (for example, academics with doctorates, critical mass of experts in a particular field, and supervision capacity). This could be done through, for example, offering joint PhDs and co-supervision. Such collaborations can be steered through research funding, where institutions are incentivised to collaborate, strengthening institutional collaborations both locally and with international partners. Collaborations among higher education institutions, especially those within the same country, could be a useful strategy for addressing the capacity constraints experienced by many of the institutions (for example, academics with doctorates). Based on these outcomes and recommendations, the study lays bare some possibilities for interventions into this very important aspect of higher education in Africa. The study considers this an urgent and priority issue that needs the concerted efforts of both local and international stakeholders.

Developing the next generation of African academics

In the section on institutional capacities for research, it was noted that, in addition to scarcity of staff with PhD qualifications, most academic staff in the institutions were aging. The rapid expansion of the higher education sector in several African countries, growth in access, and programme differentiation requires that more young doctoral graduates be trained. In recent years, there has been growing attention on developing the next generation of African academics for self-renewal and regeneration of the system (Mohamedbhai 2012, Jowi & Mbwette 2017). However, though the current data from the universities show growing enrolments in doctoral programmes, the demographics, on the other hand, indicate that the majority of these doctoral students are mature and more advanced in age than their counterparts in developed countries. Most of the candidates in the case countries completed their PhD training after attaining the age of forty (British Council & German Academic and Exchange Service 2017).Though there are challenges with entry and completion ages of doctoral candidates, in South Africa, for example, there is a strategy to prioritise younger cohorts with a focus on developing the new generation of African academics. There have also been equity concerns about doctoral training, especially on enrolments of female students. Racial inequity comes out prominently in South Africa, with efforts being made to catapult the numbers of black academics getting into PhD training. Most of these are, however, international students from other African countries studying in South African universities. While the trends keep moving towards a greater need for PhDs, the universities should utilise all opportunities available to develop this badly needed cohort of a talented new generation of African scholars.

The rise of centres of excellence and university networks

Institutional differentiation and creation of centres of excellence was recognised as an important strategy that could be utilised to address the fragmented institution-driven expansion of doctoral programmes across many of the countries. Due to the capacity deficits and the need for specialised training in different targeted areas, the Centres of Excellence (CoEs) model is beginning to take centre stage in Africa. Most of them are located in some of the established universities in Africa. The Pan African University which has six campuses or centres in the different regions of Africa is a pioneering example. The different centres specialise in different fields. The World Bank and the German government have also supported the establishment of some of these centres in different regions of Africa. In addition to supporting infrastructure, they have also provided scholarships for the students and funding to facilitate staff exchanges. Some of these centres have already graduated some of their cohorts. Through the

Inter University Council for East Africa (IUCEA), the East African region is hosting a number of these centres. There have been calls to uphold the quality of training in these centres and also to support them to attain international accreditation. They also play an important role in fostering internationalisation through academic exchanges.

Some innovative initiatives

The past few years have witnessed some innovative developments in doctoral training by some universities. A number of universities (for example, University of Ghana, University of Ibadan, Moi University, and most universities in South Africa) have strategically used their international collaborations and partnerships to develop and strengthen their doctoral training. This has been in establishing new doctoral programmes, strengthening curricula, joint research and supervision, exchange of students, and making some specialised facilities available for research. The development of Centres of Excellence in Africa through different initiatives has also been an important step. These CoEs have focused on specific areas of speciality through which students from different African countries can now obtain training. Some of them have accompanying scholarship programmes and are better equipped, thus facilitating better learning and research environments. Some universities in Africa have also developed networks and collaborations through which they facilitate research and doctoral training. These include the recently established African Research Universities Association (ARUA), Regional Universities Forum for Capacity Building in Agriculture, Consortium for Advance Resarch Training in Africa (CARTA), and several others (see Jowi & Mbwette 2017) which now enable the universities to combine their efforts to foster doctoral training.

It is also notable that some universities, such as the University of Ibadan, University of Ghana, and University of Nairobi, are tilting their focus to deliberately increase doctoral students' enrolments (Alabi & Mohamed 2017, Barasa & Omulando 2017). The growing ICT revolution is also providing several opportunities for online learning and supervision from a distance (Zeleza 2012). This has been given further impulse by the impacts of the COVID-19 pandemic that has shifted thinking and made online activities a new normal and could make this a very viable platform for enhancing doctoral training in Africa. Though still a challenge, a few innovative approaches to funding doctoral training are also coming up to augment government funding. These include funding through projects and partnerships with industry and the private sector. The DAAD model of funding PhDs in Africa emerged as one of the most viable models, especially with regard to development partners supporting doctoral

training in Africa. The establishment of National Research Funds by most governments is also an innovative move to support and sustain doctoral training.

Summary and conclusions

This article has foregrounded several developments, trends, and issues in doctoral training in Sub-Saharan Africa. It began from a background of serious challenges and deficits, but proceeded to document some of the developments in doctoral training in Africa. It showed some sense of optimism based on the outcomes of the six-country study, with an emphasis that much more still needs to be done by the various stakeholders for meaningful progress to be made in doctoral training in Africa. Currently there is higher optimism about the value of building PhD capacities in different African countries. This is in response to the already documented low capacities and the role of such specialised and high-level skills in societal development and transformation. It is important to ensure that the quality of PhD programmes is enhanced to cope with growing societal needs. Due to concerns about quality of doctoral training and socio-economic relevance, there is a need to diversify PhD training into some of the key areas which are currently excluded. The links between universities and industry seem to be rather weak except for the South African case. As the evidence from the cases indicates, stronger collaboration between universities, government, industry, the private sector, and local communities is required in order to strengthen the capacities of universities for research and development, enhance innovation and commercialisation of research, and responsiveness by universities to the need of industry is therefore necessary. The increasing demand for doctoral education suggests that enrolments will continue to increase, which will require a concomitant increase in the number of academics who can provide the required supervision. The existing capacity is inadequate. It is therefore incumbent upon the various countries to invest in increasing the number of academics with doctorates, not only to enhance supervision support but also to build capacity for research.

It is notable that some countries have recently undergone transformations in their policy frameworks, which will in the end have impacts on the research and PhD training environment. Overall, the number of PhD programmes and enrolments into the programmes have significantly grown in the last ten years, especially in the highlighted countries. This trend paints an optimistic future for doctoral training and research in Africa. Ethiopia presents a very striking example of phenomenal growth from only two PhD programmes in 2006 to 138 in 2015. In the entire sector across most of the countries, PhD training as a proportion of overall student enrolment remains remarkably low. There is progress being made in enhancing the numbers of staff with PhDs,

with the trends showing that this could change rapidly and have an overall impact on research and PhD production in the coming years.

Given the relatively low enrolments in doctoral programmes in the countries illustrated in this article, there is a need for universities to increase enrolments and graduation rates. This requires, inter alia, an increase in the supervisory capacity of universities, and an expansion and improvement in research infrastructure, and a rethinking of the funding of doctoral education. In addition, scholarships and bursaries for doctoral students should consider the fact that most doctoral students have to balance their studies with financial responsibilities to their families.

Institutional differentiation and the creation of centres of excellence is an important strategy that could be utilised to address the fragmented institution-driven expansion of doctoral programmes across many of the countries. Differentiation will ensure, inter alia, that institutions offer doctoral programmes only in areas in which they have the requisite capacity, optimisation of the existing limited capacity, and that resources are concentrated in areas where institutions have the potential to be excellent.

The realisation of a strong alignment between university research, doctoral education, and national research priorities requires the implementation of robust national frameworks to steer the behaviour of all concerned actors (universities, industry, and government). Research funding and incentives are important mechanisms for steering such alignments: for example, by prioritising areas that are aligned with national priorities. As in other fields, data remains a major challenge in analysing developments in doctoral training in Africa. Availability and coordination of data thus remain perennial issues.

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